FORESTRY ABSTRACTS

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STATISTICAL METHOD AND FORESTRY

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THE necessity for making objective quantitative statements with regard to occurrences and phenomena, and for accurate expression in any matter involving measurement, has been driving foresters, for some time past, increasingly to use statistical methods in the analysis of quantitative data. Statistical methods are merely methods of mathematical analysis specially adapted to the elucidation of quantitative data affected by a multiplicity of causes: that is to say, they are the means necessary for making accurate statements with regard to numerical data, and anyone who attempts accuracy in statement eventually finds that these methods must be adopted. One of the principal signs that forestry has begun to realize this is to be seen in the slow stream of papers and bulletins published during the last twenty years in which a summary description of statistical methods is given, together with illustrations of their use in forestry problems. An early and excellent example is the bulletin published in 1925 on 'Statistical Methods in Forest Investigative Work' by W. G. Wright [16]. This is concerned with the numerical definition of the characteristics of forest crops by means of the arithmetic mean and the standard deviation, and with the determination of correlation and regression between related characteristics. Methods of sampling and the making of tests for significance are dealt with simply. The illustrations used in the bulletin show that it was compiled mainly for the use of those engaged in forest mensuration. The logical consequence of this work is seen in the textbook on forest mensuration by Bruce and Schumacher [3]. This was a pioneer among books on mensuration, mainly in its direct advocacy of statistical methods which, it claimed (in the preface to the 1st edition, 1935) had made the largest contribution in providing new tools for use in this subject. Yet, among other textbooks on statistical method, Udny Yule's 'Introduction to the Theory of Statistics' had appeared twenty-five years earlier (1910) and had reached its eleventh edition by 1938 [17]. It would appear that foresters had not helped, to any great degree, to make necessary the successive editions of this or any similar textbook, and their failure to do so is shown by the lack of any widespread and efficient use of statistical method for forestry purposes during this period.

In Wright's bulletin [16] the useful statistical methods are set out conveniently with the minimum of explanation. Indeed, the author claimed no more than this, and referred the more ambitious reader to suitable textbooks. A publication of very similar type, but of quite recent date (1943), is that written by Forsaith [8], and produced principally with the requirements of the wood technologist in mind; but statistical methods which are suited to the determination of the quantitative characteristics of populations of fibre lengths, or cell diameters, are, within limits, equally well suited for the analysis of data regarding the height or diameter of trees. Yet another example of this type of work is seen in an unpublished paper by Barnard [2], also written for the wood technologist, which covers very similar ground to the bulletin by Forsaith, but in less detail. Neither of these more recent works makes any real advance on the bulletin by Wright. So far as they go they are satisfactory, but anyone who becomes seriously engaged in the use of statistical method will usually find that such essays are inadequate both in their explanation of methods and in their demonstration of the theoretical background which is necessary for the critical use of these methods.

Another aspect of statistical analysis for which no specifically forestry publication has yet appeared is dealt with in a bulletin by Saunders [12] on 'Statistical Methods with Special Reference to Field Experiments'. Gobeil [9] also refers very shortly to this aspect of statistical work. We are here concerned with techniques designed to show the significance of differences in the yield of crops, which have arisen owing to differences in the treatment received or in the varieties or species compared. This branch of statistical analysis has been highly developed in connexion with agriculture and horticulture and is of considerable use in forestry, especially in connexion with silvicultural and nursery experiments. Both its comparatively recent development and its present extensive use are indicated by the 112 literature references cited by Saunders: none of these is earlier than 1911, and the great majority refer to works published during the last twenty years. Champion's 'Silvicultural Research Manual' [4] was written for the guidance of foresters in India who are engaged in experimental silviculture. So far as the use of statistical method is concerned, it covers in a simple and elementary manner the statistical technique used in field experiments. It is valuable not so much as a work of reference for method, as for the recognition it gives to the importance of statistical techniques in the analysis of data obtained in field experiments. It is of further importance because of the considerable attention it gives to the laying-out and maintenance of experiments and to the recording of work done and results achieved. This is an aspect of experimental and observational work which tends to be overlooked and for which summary compilations, such as those of Wright and Forsaith, find little, if any, space. It is hardly possible, however, to pay too much attention to the manner of collection of data which are subsequently to be analysed, and faults in this respect may nullify the value of any analytical method.

Yet another aspect of statistical method is illustrated by the work of Schumacher and Chapman [13]. They are concerned mainly to show how the characteristics of a crop covering an area, or the types of land utilization or

natural vegetation covering a whole region, may be sampled and determined quantitatively. The techniques described can be used for problems ranging from the estimation of amounts of nursery stock to the determination of the proportions of a large area of country occupied by various types of usage or vegetation. They are also of use in cruising, for the estimation of the volume of standing timber. Recent works such as those by Hasel [10] and Osborne [11] show that this is an aspect of statistical method which is still developing; nevertheless, the techniques already evolved are of great value and should not be ignored by foresters engaged in work for which they are appropriate.

The papers by Dwight [5, 6, 7], while written to give instruction in method, differ from the other instructional bulletins and papers referred to in that each is concerned with a particular problem. The first paper describes a method of plotting freehand curvilinear regression lines such as are commonly met with in determining the relationships between factors in mensuration, e.g. height and diameter. The aim is to obtain a sufficiently accurate result by a less laborous method than that normally adopted in statistical method, in fitting curved regression lines. It is obviously of no use to be more accurate than the occasion warrants and this is a case where experience may show that the less orthodox method is adequate and sufficient, at least in some circumstances. The second paper is likewise concerned with the simplification of methods, this time in connexion with the construction of volume tables. The third paper is an attempt to make plain to the ordinary, relatively non-mathematical person, the principles and method underlying the fitting of linear regression lines by the method of least squares. The importance of these papers lies in their representing a continued effort to combine adequate accuracy in result with maximum simplicity in method, bearing in mind the probable mathematical attainments of those who will generally use the method, as well as the amount of labour and time involved. Beginners usually find statistical method a new and strange field of considerable complexity. Most of those who use the tools provided by it never progress beyond the mere understanding that data of a particular type may be analysed by the use of a particular method, and in these circumstances simplicity and clarity are of great importance. This is well illustrated in the bulletin by Stoate and Lane-Poole [14], which consists solely of examples taken from particular forestry problems, showing various methods worked out in detail, so that those who use them may have the minimum chance of falling into error. The review of this bulletin by Van Rest [14] should be consulted, as it corrects a number of typographical errors and also gives a select list of textbooks of statistics suitable for reference by foresters.

Enough has been said to show the wide application in forestry of the techniques for quantitative analysis developed in statistical method. There can be no doubt as to the necessity for their use if forestry is to progress. Bruce and Schumacher remark, in the preface to the 1st edition of their book [3], 'Had courses in mensuration been more concerned with the best use of the best tools, these new devices [i.e. statistical methods] would long ago have been adopted by the forestry profession'. Allan [1], in a short review of the use of statistical methods in forestry research, remarks 'It is therefore very important that experiments in forestry should be properly planned, so that time and expense will not be wasted on useless investigations, and the results when obtained will be statistically sound'. These are merely expressions of obvious common sense to those who are acquainted with the present situation in forestry and its requirements as regards technique in the collection and analysis of data.

In these circumstances it may be asked, how satisfactorily are the requirements of forestry being catered for, and to what extent is it desirable for instruction in statistical method to be introduced into forestry education? Let the second question be taken first. The real importance of a knowledge of statistical principles and method to the ordinary practising forester is that it enables him to think and work more accurately than he could do otherwise. As forestry becomes more highly developed, it is becoming increasingly difficult to exclude some training in statistics from forestry education at any university school; soon it will be quite impossible to do so. Statistical method is, however, so extensive and difficult a subject, even if no attempt is made to understand the higher mathematical theory on which it is based, that no more than a very general and elementary introduction to it will ever be possible in the ordinary undergraduate course of university forestry education. This will make possible the solution of simple problems and the understanding of the manner of statement used by more advanced students of statistics. If this is true, it follows that in forestry there must be a gradation in understanding with regard to statistics. Most foresters will require an elementary understanding of the general principles; research workers will need to be efficient at least in some aspects of statistical technique and possessed of some critical faculty in its use. But behind the forestry research worker must stand the mathematical statistician, without whose expert knowledge and guidance there can be no certainty or progress in the use of statistical method. This, then, is the statistical hierarchy necessary for forestry; we are at present in a transition period in which the truth of this is slowly being realized, as those responsible for administration come to see what is the true function of statistical technique in forestry.

If statistical method has this considerable importance for forestry, how well are foresters served by the literature at present available? The answer is that, while foresters can usually find something adequate for their needs in books written for other branches of applied biology, or for students of the social sciences in the case of forest economics, there is no work, so far as the writer knows, which adequately deals with their requirements in statistical method from an intimate knowledge of the needs of forestry. The larger number of the few works written for foresters and reviewed above, are good so far as they go, but no one can pretend that they are anything but brief and convenient summaries which, useful though they may be, cannot enable the student to come to a proper appreciation of the subject or to develop any critical faculty in the use of the techniques it offers. The works of Bruce and Schumacher and Schumacher and Chapman are exceptions to this but they deal only with limited and restricted fields. One of the present needs in forestry is, therefore, the writing of books dealing in a fundamental and adequate manner with statistical principles and methods. The field to be covered is so large that no one volume of convenient size could cover it. When, it may be asked, will this need be satisfied? This will happen when the statistical hierarchy described above has been established throughout the forestry services and,

through experience and effective service, has gained a position of recognized value. Until then it is only too probable that foresters will, as Van Rest suggests, have to search over a wide field of literature in order to satisfy their needs.

REFERENCES

[1] ALLAN, F. E. The use of statistical methods in forestry research. *Aust. For.* 2, 1937 (5–10).
[2] BARNARD, M. M. Elementary statistics for timber research workers. Division of Forest Products, C.S.I.R., Australia. [1940?]. pp. 34 + tbls.
[3] BRUCE, D., and SCHUMACHER, F. X. Forest mensuration. McGraw Hill Book Co., Inc., New York and London. First Edition, 1935. pp. 360. Second Edition, 1942. pp. 425.
[4] CHAMPION, H. G. Silvicultural research manual for use in India. Vol. I. The experimental manual. Government of India, Central Publication Branch, Calcutta. 1931. pp. 181.
[5] DWIGHT, T. W. Refinements in plotting and harmonizing freehand curves. *For. Chron.* 13, 1937 (357–70).
[6] —— The percent. deviation method of constructing volume tables. *For. Chron.* 13, 1937 (409–16).
[7] —— The fitting of linear regression lines by the method of least squares. *For. Chron.* 13, 1937 (509–19).
[8] FORSAITH, C. C. Statistics for foresters. *Tech. Publ. N.Y. St. Coll. For.* No. 62, 1943. pp. 69.
[9] GOBEIL, R. Importance des statistiques dans les travaux forestiers. *For. québec.* 2 (2), 1940 (31–48). [Corrections in 2 (4), 1940 (43).]
[10] HASEL, A. A. Estimations of volume in timber stands by strip sampling. *Ann. math. Statist.* 13 (2), 1942 (179–206).
[11] OSBORNE, J. G. Sampling errors of systematic and random surveys of cover-type areas. *J. Amer. statist. Ass.* 37, 1942 (256–64).
[12] SAUNDERS, A. R. Statistical methods with special reference to field experiments. *Sci. Bull. Sth. Afr. Dep. Agric. For.* No. 200, 1939. pp. 112.
[13] SCHUMACHER, F. X., and CHAPMAN, R. A. Sampling methods in forestry and range management. *Bull. Duke Univ. Sch. For.* No. 7, 1942. pp. 213.
[14] STOATE, T. N., and LANE POOLE, C. E. Application of statistical methods to some Australian forest problems. *Bull. Commonwealth For. Bur.* No. 21, 1938. pp. 71.
[15] VAN REST, J. C. Statistical methods for the forester. *Emp. For. J.* 18, 1939 (101–5).
[16] WRIGHT, W. G. Statistical methods in forest-investigative work. *Bull. Can. For. Br.* No. 77, 1925. pp. 36.
[17] YULE, G. U., and KENDALL, M. C. An introduction to the theory of statistics. Griffin, London. 11th Edition 1938. pp. 570.

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

01. NOMENCLATURE. BIBLIOGRAPHY

01.2. RENDLE, B. J. **Nomenclature problems of the applied biologist.** *Nature, Lond.* 154, 1944 (812–4).

At a meeting of the Association of Applied Biologists on November 10, 1944, a discussion took place on practical problems of botanical and zoological nomenclature. The discussion served to clarify the distinction between name changes due to advances in taxonomy and those due to conventions such as the law of priority. There is a strong case to be made against name changes which do not signify any progress in taxonomy. Several suggestions were put forward by botanists to restrict changes due to the principle of priority, either by introducing a time limit for the reviving of an old name, or by amending the rules so as to allow of the rejection of names which are clearly undesirable. A formal proposal that the Council of the Association of Applied Biologists should examine the question was carried without dissent.

01.6 (485). BRAUNS, O., HOLST, G., JOHNSON, T., NEVRELL, T. H., and WALDENSTRÖM, E. Den tekniska litteraturtjänsten till skogsindustriernas samarbetsutskott. [**The technical bibliographical service for the co-operative committee of the forest industries.**] *Svensk PappTidn.* 47, 1944 (292–3). [SW.] P.O.

Deals with the promotion of a bibliographical information service within the sphere of technical forestry, and the wood and paper industries. The names of collaborators are given at the end of the article. M. L. C. W.

02. HANDBOOKS. DICTIONARIES

02.4 (73). **Forest terminology. A glossary of technical terms used in forestry.** Society of American Foresters, Mills Building, Washington 6, D.C. 1944. pp. 84. Price 11s. net.

Existing glossaries of forestry terms are now out of date owing to the development and enlarged scope of the subject, and a tendency to use technical terms inaccurately has developed, particularly during the last decade. This glossary, which is published by the Society of American Foresters, was compiled by 10 subcommittees, each consisting of experts in the subject assigned to it. The glossary is limited to (1) terms used in a special sense by foresters, and (2) terms from other sciences and industries, the meaning of which a forester should know and which may not be defined in other glossaries or texts likely to be easily available to the average forester. The policy has been to exclude (1) terms which are found in a common dictionary and are used with the common dictionary meaning, (2) terms with self-evident meaning, (3) terms in forest industries, which are not at all or only remotely connected with the relation of that industry to forestry. The Society invites amendment, criticisms, and suggestions for improvement of the glossary. A list of existing glossaries in allied subjects is included.

05. PERIODICALS

05.3. *Annual Reports*

05.3 (410) : 33.51. GREAT BRITAIN. **Ministry of Fuel and Power. Twenty-second annual report of the Safety in Mines Research Board, 1943.** H.M. Stationery Office, London. 1944. pp. 30.

05.3 (54.87). CEYLON. **Forest Conservancy. Report of the Conservator of Forests for 1942.** Ceylon Govt. Press, Colombo. 1944. pp. 6.

05.3 (66.7). GOLD COAST. **Report on the Forestry Department for the year 1943–44.** Govt. Printer, Accra. 1944. pp. 6.

05.3 (67.6). UGANDA. **Forest Department. Annual report for the year ended 31st December, 1943.** Govt. Printer, Uganda. 1944. pp. 8.

05.3 (68.9). NORTHERN RHODESIA. **Department of Agriculture. Annual report for the year of 1943.** The Director of Agriculture, Mazabuka. 1944. pp. 11.

05.3 (68.9). SOUTHERN RHODESIA. **Report of the Secretary, Department of Agriculture and Lands, for the year 1940.** Govt. Stationery Office, Salisbury. 1941. pp. 45.

05.3 (68.9). NYASALAND. **Annual report of the Forestry Department for the year ended 31st December, 1943.** Govt. Printer, Zomba. [1944.] pp. 12.

05.3 (71.3). ONTARIO. **Report of the Minister of Lands and Forests of the Province of Ontario for the fiscal year ending 31st March, 1943.** Govt. Printer, Toronto. 1944. pp. 152.

05.3 (728.2). BRITISH HONDURAS. **Report of the Forest Department for the year ended 31st December, 1943.** Govt. Printer, Belize. 1944. pp. [8] + tables.

05.3 (74.7). NEW YORK. **Report of the New York State College of Agriculture and of the Cornell University Agricultural Experiment Station for the year 1942–43.** Cornell University, Ithaca, N.Y. 1943. pp. 190.

05.3 (88). BRITISH GUIANA. **Report of the Forest Department for the year 1943.** Govt. Printer, Georgetown. 1944. pp. 3.

05.3 (931). NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

05.3 (94). AUSTRALIA. **Annual report of the Commonwealth Forestry Bureau for year 1943.** Commonwealth Govt. Printer, Canberra. 1944. pp. 12.

06. CONVENTIONS. CONFERENCES

06.2. GRAVES, H. S. **Significance of international collaboration in forestry and forest products.** *J. For.* 42, 1944 (705–8).

The author, who is Chairman of the Sub-committee on Forestry and Forest Products (United Nations'

Interim Commission on Food and Agriculture), discusses the possibilities of international collaboration in forestry with particular reference to the contribution American foresters can make to such collaboration and the problems involved.

07. EDUCATION AND RESEARCH

07.1 (485). Skog och träförädling kursämne i Norrland. **[Forest and tree improvement as the subject of a course in Norrland.]** *Svensk PappTidn.* 47, 1944 (301). [Sw.] P.O.

A brief note on this first occasion on which Swedish forests and timber have been the subject of a course, conducted by experts for the public. M. L. C. W.

09. PRE-HISTORY. FOREST STATISTICS. FOREST GEOGRAPHY

09.2. *Pre-history*

09.2 (54.1) : 12.26–8 : 12.29. GHOSH, A. K. **Petrified wood from some new localities in Bengal.** *Abstr.* in *Proc. 30th Indian Sci. Congr.* Part 3, 1943 (37). L.S.

The author records the occurrence of two silicified dicotyledonous woods and one silicified monocotyledonous wood (*Palmoxylon*) in beds of laterite alluvium in three localities in Bengal.

09.2 (54.3) : 31.1 : 12.25. SHUKLA, V. B. **On two new spp. of petrified gymnospermous woods from the Chindwara district, C.P.** *Abstr.* in *Proc. 30th Indian Sci. Congr.* Part 3, 1943 (51). L.S.

Two silicified woods (*Dadoxylon*, sp. nov., and *Cupressinoxylon*, sp. nov.) are described. The *Dadoxylon* species shows an interesting feature in the combination of alternate and opposite pits and may be considered as a connecting link between the Abietineae and Araucarineae. The *Cupressinoxylon* species resembles *C. alternans* Sahni to some extent, but differs from it in the biseriate nature of the medullary rays, the absence of well-marked growth rings and a few other features.

09.2 (76.4) : 12.25. POTZGER, J. E., and THARP, B. C. **Pollen record of Canadian Spruce and Fir from Texas bog.** *Science* 98, 1943 (584). L.S.

A preliminary pollen analysis of a deep peat deposit in a bog in Lee County, Texas, showed the following changes in the composition of the vegetation: Spruce/Pine/Oak/grasses, to Oak/grasses, to grasses, to Alder, to Chestnut/Alder, to Chestnut/Oak/grasses, to Oak/grasses. Up to 5 per cent. of Canadian Spruce and Fir pollen was recorded in the lower 5 ft. of the bog, which is approximately 800 miles south of the present southernmost profile recording these genera.

09.2 (79.6) : 12.19.4 : 43.3. HANSEN, H. P. **Post-pleistocene forest succession in northern Idaho.** *Amer. Midl. Nat.* 30, 1943 (796–802).

Pollen profiles of a peat bog in Northern Idaho show Lodgepole Pine (*Pinus contorta*) to be the predominant, pioneer tree species in the post-glacial period. This was gradually superseded by Western White Pine (*P. monticola*), which remains generally predominant to the present time. Two periods of severe and recurring fires are shown in the profiles by the relative trends of Western Larch (*Larix occidentalis*) and Lodgepole and Western White Pine. There is no evidence of a trend towards the local climax forest, apparently because of the frequency and severity of the fires.

09.4. *Forest Statistics*

09.4 (71.4) : 98.1. RACINE, E., and RICHARD, R. La forêt dans l'économie du Saguenay-Lac-Saint-Jean **[The forest in the economy of Saguenay-Lake St. John.]** *For. québec.* 8, 1944 (310–36). [F.]

The territory dealt with has an area of 27,889 sq. miles, of which 86 per cent. is forest. Except in the immediate neighbourhood of Saguenay and Lake St. John the predominant species are White Spruce (*Picea glauca*) and Balsam Fir (*Abies balsamea*). White Birch (*Betula papyrifera*) and Aspen (*Populus tremuloides*) occupy the banks of rivers and lakes. Jack Pine (*Pinus banksiana*) takes possession of deep sandy soils after fire. More than 40 per cent. of the forest is not leased, and constitutes an important reserve. This is the largest block of forest in the whole Province, and also contains the greatest volume of wood, about 18,000 million cu. ft. Conifers represent about five-sixths of the stock. The amount of saw timber is estimated at 2,682,576,000 cu. ft. The usable increment per acre is estimated at 19·7 cu. ft. (16 cu. ft. conifers and 3·7 cu. ft. hardwoods). In 1941, a total of nearly 83 million cu. ft. of timber was cut to supply the pulp and paper factories in the area. In order to meet a demand of this size, there has been over-exploitation of the more accessible areas. It is suggested that the time has now come for industrial undertakings and the Government to co-operate in opening up the reserves of timber in the basins of the Peribonka, Mistassini and Du Chef rivers.

09.4 (75.8–9 : 76.1–6) : 98.1 : 90. DEMMON, E. L. **Southern forests—a renewable resource.** *Sth. Pulp Paper J.* 7, 1944 (48, 50).

A discussion of the forestry situation in the eight Southern States from Florida and Georgia in the east to Texas and Oklahoma in the west. About 170 million acres of forest still survive but, owing largely to past fires and cutting practices, they are growing at less than half their productive capacity. About 33 per cent. of the forest land in the Lower South is owned by farmers; about 8 per cent. is in national or State forests; possibly another 8 per cent. is in public ownership as a result of tax forfeiture; and the rest is in the hands of industrial undertakings. Southern forests support industries employing the equivalent of almost 500,000 full-time workers. The pulp and paper industry of this region expanded rapidly in the period, 1930–40, and now accounts for about 50 per cent. of all the pulp produced in the United States. Measures recommended for the protection and improvement of these forest resources are increased public ownership, properly organized fire protection (less than one-half of the forest area is at present under organized fire protection), protection from injurious insects and diseases, replanting of barren or poorly stocked areas, and legislation to regulate cutting practice.

09.7. *Monographs of Individual Forest Regions*

09.7 (41.5) : 12.25–8 : 23.21. MCEVOY, T. **Irish native woodlands: their present conditions.** *Irish For.* 1, 1944 (27–35).

A short account of the original extent and present survivals of Irish native woodland, together with notes on the native tree species, and naturalized introductions. The latter include Beech, Sycamore and Scots Pine.

09.7 (47.6) : 09.1 : 12.19 : 43.3 : 45.1 : 23.21. GAMS, H. **Die Wälder Südrusslands und ihre Geschichte. [The**

forests of southern Russia and their history.] *Forstarchiv* 19, 1943 (69–85). [G.]

The development of vegetational types in southern Russia has been conditioned to a large extent by five factors: (1) the repeated overflowing of the Black Sea and the Caspian Sea, which, even during the last Ice Age, covered a large part of the neighbouring lowlands to the north; (2) glaciation and other disturbances during the Ice Age; (3) the continental climate with its low precipitation and great variations in temperature throughout the greater part of the area, and the high-mountain climate of the Caucasus; (4) the salt deposits left by the retreating sea, and (5) damage by grazing, often accompanied by forest clearance and burning of the steppe.

After dividing the area into six main zones, the author discusses the composition of the natural forests and reviews the vegetational development of the area from pre-historic times. Much damage has been caused to the forests by grazing, over-exploitation and forest and steppe fires. Afforestation of deforested areas and of the timberless steppe has been in progress for many years. In addition to indigenous hardwoods, such as Oak, Maple, Elm, Ash and Birch, fruit trees, Pines, and many exotics have been planted. The latter include *Pinus nigra*, *Juniperus virginiana*, *Robinia*, *Gleditsia*, *Acer negundo*, *Morus alba*, *Elaeagnus angustifolia* and many shrubs such as *Caragana arborescens*, *Amorpha fruticosa* and *Lycium barbarum*.

09.7 (47.6) : 12.19 : 45.3 : 32.9 : 98.2. WACHHOLTZ, R. Die forstlichen Verhältnisse und die Voraussetzungen einer Holzwirtschaft in der Ukraine. **[The forest situation and the bases of a timber economy in the Ukraine.]** *Forstarchiv* 19, 1943 (55–69). [G.]

After a review of the geographic, soil and climatic conditions obtaining in the Ukraine, the author discusses the distribution and composition of the forests of the country. Forest land includes (1) the swampy-sandy depressions traversed by flat sand dunes and covered for the most part by pure Pine woods or Pine mixed with Oak and Birch; (2) the steppe woodland area, with a well-mixed vegetation predominantly of Hornbeam and Oak of good quality but including various other hardwoods and some islands of Pine; and (3) the steppe itself which supports a dry type of Elm/Oak forest, or restricted woodlands of Oak, Poplar, Elm, Aspen and Alder on the bottomlands of the Dnieper. Data are given on the age and composition of the timber stands of the Ukraine as well as on their yield and utilization.

Among the most important insect pests in Ukrainian forests are *Dendrolinus pini* and *Lophyrus pini* attacking Pine, and *Zeuzera pyrina* attacking Ash. Damage is also caused by various bark beetles, May beetles, and the fuller beetle (*Polyphylla fullo*). Elm stands have been badly infected with the Dutch Elm disease [*Graphium* (= *Ceratostomella*) *ulmi*].

The transport of timber has been a particularly difficult problem owing to the destruction of the Kowel-Sarny-Kiev railway by the Russians and the lack of adequate road or trail transport to take its place. Transport of logs by water has been of the greatest importance for supplying the timberless south. Sawmilling, plywood manufacture and the woodworking industry are generally in an unsatisfactory state, partly due to the out-of-date methods and equipment used. Nevertheless, under proper management, the forest and timber industries of the Ukraine seem capable of very extensive development.

09.7 (54.1) : 12.19 : 23.1. CHENGAPA, B. S. **The Andaman forests and their regeneration.** *Indian For.* 70, 1944 (297–304, 339–51, 380–5, 421–30).

After a general account of the Andaman Islands and the forest types, the writer gives a review of the present condition of the forests. The proportion of valuable species is very small, and these are found scattered in a useless crop over the whole area. Recent fellings in regeneration areas showed that the yield per acre of merchantable timber is rarely more than 16 tons. The valuable species, with few exceptions, are mostly deciduous or semi-deciduous and occupy the topmost storey; they are overmature with a large percentage of hollow and unsound trees. Younger age classes are very poorly represented or even non-existent. Whatever the cause, it seems to be a fact that the Andaman species now well known in the market, are only transient and a stage in succession to a climatic climax, and may disappear unless foresters can stop this natural process. The principal obstacle in the way of natural regeneration of the deciduous, light-demanding species, is the dense undergrowth of evergreen shrubs and creepers. A short history of attempts at regeneration and introduction of exotics since about 1880, shows that these were for the most part failures. Details are given of more recent experiments, and the conclusion is drawn that natural regeneration of Padauk (*Pterocarpus dalbergioides*), White Dhup (*Canarium euphyllum*), White Chuglam (*Terminalia bialata*), Gurjan (*Dipterocarpus* spp.), Koko (*Albizzia lebbek*), and others can be induced, and the best results obtained at a cost much below that of artificial regeneration, by removing the undergrowth completely, raising the canopy to 60 ft., burning the slash if necessary, and constant weeding. Details are given of the methods recommended for carrying out regeneration fellings and tending the young crop.

Rather different methods were found to be necessary for regeneration of wet evergreen forest. At least a year before any evergreen forest is due for felling, undergrowth up to a height of 20 ft. should be cleared. Unwanted trees should be girdled. No burning should be done.

Investigation is still necessary on a number of points such as the determination of the number of weedings necessary, climber cutting, cleaning and thinning, the best mixtures, the effect of rapid growth on match wood species, correct rotation for different species. Details are given of some experiments already carried out on these problems.

09.7 (82) : 98.1 : 90. **Argentina's forest resources. Present exploitation and the destructive forces at work.** *Rev. Riv. Plate* 95 (2699), 1943 (19–22, 24).

The forests of Argentina, which are distributed by regions or zones throughout the country, vary greatly both in density and character in accordance with the wide range of soils and climatic conditions to be found there. Each of the forest zones contains a considerable number of species, usually in mixture, and there is a high percentage of hardwoods and a disproportionate shortage of conifers. However, useful statistical data on the forests of the country are almost entirely lacking; the only figures available refer to 1915 and

are not applicable at present owing to the heavy cutting and destruction that has been going on in the intervening years. The area of planted forest for the country as a whole is given by the Agricultural Census of 1937 as 1,485·6 sq. km.

The Red Quebracho (*Schinopsis* sp.) is probably the most important single tree in Argentina; this species is being exploited wastefully for tannin production and is not being replanted. There are many other valuable species that are gradually being recognized, though often they are being used for inferior purposes such as firewood.

Apart from reckless exploitation and inefficient utilization (e.g. manufacture of charcoal with complete neglect of valuable by-products) the forests of Argentina are suffering considerable losses due to fire, insects and disease. The only area where silviculture has been practised to any extent is in Buenos Aires Province and the Parana delta area, where Poplar plantations have been established on a considerable scale; this work has, however, been stopped owing to some of the Poplars becoming infected with rusts (*Melampsora* spp.).

This paper concludes with suggestions for (1) more efficient forest utilization under official direction, and (2) definite research projects concerned with (*a*) a comprehensive laboratory study of Argentine woods and (*b*) an investigation of the lignins from Argentine forest products, wastes, and cellulose materials in general. [See also *Maderil* 17 (194; 195), 1944 (13–5, 25–7; 7–9).]

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.4. *Soil*

11.41. Soil Physics

11.41.1 : 21.62 : 12.25 : 12.19.4. BURNS, G. P. **Studies in tolerance of New England forest trees. XV. Soil temperature as influenced by the density of White Pine cover.** *Bull. Vt. agric. Exp. Sta.* No. 513, 1944. pp. 35.

Following thinning of natural White Pine stands in the Champlain valley of Vermont, the natural succession tends to replace the White Pine with hardwoods consisting of Maple with Birch, and some Hemlock. The study reported in this bulletin was undertaken to obtain information on related changes in the habitat; it is mainly on the basis of meteorological data that silvicultural practices must develop to ensure the continuance of pure White Pine stands and prevent the natural succession. Data on soil temperature were collected in autumn, winter and spring months on three selected plots located: (1) in a forest nursery, the area being treeless and bare of all vegetation and litter; (2) in a natural forest stand that had been thinned; (3) in an unthinned forest stand.

The thinning brought about important changes, especially in soil temperatures of 50° F. and higher. It was found that at a depth of 3 in. the natural forest delayed the earliest freezing date by 26 days, and the thinned forest by 10 days, beyond that occurring on the bare control plot. Fluctuations in soil temperature in a forest were found to be quite independent of those in air temperature.

Records were kept over a period of 10 years, and a comparison of averages for that period with data for a single sample year shows the uselessness, in respect of survival and rate of development of seedlings, of such average figures; data for single years will indicate critical periods and are therefore highly important.

11.42. Soil Chemistry

11.42.1 : 12.19 : 12.26–8. OLSEN, C. **Natural clearings in a Beech forest on high-lime soil.** *C.R. Lab. Carlsberg* (*Sér. chim.*) 24, 1943 (315–32). *Chem. Zbl.* II, 1943 (167). Chem. Abstr. 38 (6449). P.R.

Analysis of a Beech-forest soil showed a $CaCO_3$ content of 57 per cent. which increased to 83–87 per cent. in the naturally occurring clearings. Zones bordering on these clearings and having a $CaCO_3$ content of 74–82 per cent. carried a shrubbery of Cornelian Cherry around which was a region of chlorotic Beech trees on soil containing 57–74 per cent. $CaCO_3$.

11.43. Biology of Soil, including Mycorrhiza

11.43.1 : 12.25 : 12.21. MACDOUGAL, D. T., and DUFRÉNOY, J. **Mycorrhizal symbiosis in *Aplectrum*, *Corallorhiza* and *Pinus*.** *Plant Physiol.* 19, 1944 (440–65). R.A.M. 24, 1944 (29).

The results of a comparative study in California on the endophytic mycorrhiza of the orchids *Corallorhiza maculata* and *Aplectrum hyemale*, and on the ectendotrophic symbiont of the Monterey Pine (*Pinus radiata*) are presented.

The Pine-symbiont association does not appear to be connected with any heritable morphological alterations. The short lateral rootlets are invested directly by hyphal branches of the mycelia in the soil. The distribution of the hyphae in the cortex extends only as far as the endodermis in which catechol tannins are formed; the middle lamella of the outer cortex is traversed and its disintegration products are available for absorption. Palmated, branching hyphae enter the cortical cells and become closely intermingled with a minutely vacuolate cytoplasmic mass, suggestive of a mechanism of exchange. The phenolic compounds in the root pericycle and endodermis, on escape from the vacuoles, oxidize to tannin, which "fixes" the protoplasm as seen in the brown peripheral layers of old mycorrhiza.

11.43.1 : 12.25 : 12.21. MACDOUGAL, D. T., and DUFRÉNOY, J. **Study of symbiosis of Monterey Pine with fungi.** *Yearb. Amer. phil. Soc., 1943*, 1944 (170–4). R.A.M. 24, 1945 (30).

The mycorrhizal partner of the Monterey Pine (*Pinus radiata*) in California, when actively penetrating the root tissues, gives an intense blue coloration with the molybdenum reagent indicative of bound phosphorus dissolved in the vacuolar solution. Reaction with paraphenylenediamine, resulting in the formation of indophenol blue, affords evidence of high oxidase activity in the ectendotrophic mycorrhiza. The production of indophenol blue with 2–6 dichloroquinone chloroimide indicates an abundance of pyridoxin in the mycorrhiza, located principally in the outer hyphae in contact with the soil, and in the 'mantle'. It is the remobilization of pyridin derivatives from the soil by the symbiotic fungus, and their translocation by the latter to the root cells, that enables isolated root segments of the host to survive and develop.

11.43.1 : 12.26–8 : 12.21. SCHAEDE, R. **Die pflanzlichen Symbiosen. [Plant symbioses.]** G. Fischer,

Jena. 1943. pp. viii + 172. [G.] *Abstr.* in *Zbl. Bakt.* Abt. 2, 106 (1–4), 1943 (51). R.A.M. 23, 1944 (143).

Included in this treatise on plant symbiosis are sections on the associations between Actinomycetes and *Alnus, Casuarina, Coriaria, Elaeagnus, Hippophaë* and *Myrica.*

11.43.1 : 12.14.8 : 12.26–8. SCHAEDE, R. Die Symbiose in den Wurzelknöllchen der Podocarpeen. **[Symbiosis in the root nodules of the Podocarpeae.]** *Planta* 33 (5), 1943 (703–20). [G.] R.A.M. 23 (401–2).

Full particulars are given of the writer's studies at the University of Breslau on the nature of the symbiotic process in the root nodules of *Podocarpus chinensis* and *P. nubigena.*

11.47. Maintenance of Favourable Soil Conditions

11.47 : 11.48.2 (43.1–5) : 11.41.2–3. HEINRICH, F. Zur Wirkung intensiver Bodenbearbeitung auf Wasserhaushalt und Bodenzustand forstlich genutzter diluvialer Sandböden Norddeutschlands. **[On the effect of intensive working of the soil on the water economy and the soil condition of diluvial sand soils under forest in northern Germany.]** *Z. Forst- u. Jagdw.* 74, 1942 (374–404). [G.g.] [Forstliche Hochschule Eberswalde.]

An account of investigations to determine the effect of intensive working of the soil (without soil flora or humus cover) in diluvial sand soils under forest. While soil aeration and the pore volume of the soil were markedly increased, no change was observed in mobile mineral plant nutrients or in the biological condition or acidity of the soil. The effect on water relations varied widely in the two sites studied.

11.47.2 : 12.19.23 : 12.25 (43.1–5) : 12.19.4. GOETZ. Zum Bodenflorawechsel auf den absoluten Kiefernböden Schlesiens. **[On changes of ground flora in the 'absolute' Pine lands of Silesia.]** *Allg. Forst- u. Jagdztg.* 119, 1943 (1–8). [G.]

The value of *Vaccinium* as a pioneer plant in preparing certain acid sandy soils in Silesia for Pine regeneration is emphasized. These soils are covered with a thick layer of raw humus and bear no ground vegetation. Suitable light conditions, brought about by opening the stand, enable *Vaccinium* to invade such areas and loosen the tightly packed humus. The increased soil aeration makes possible the establishment of other species, notably the moss *Hypnum.* The *Vaccinium/Hypnum* association continues until changed conditions of light or lack of raw humus causes both gradually to give way to patches of young *Calluna,* which later becomes the dominant species. At this intermediate stage, when the flora consists of a mixture of *Calluna, Vaccinium* and *Hypnum,* conditions are eminently suitable for Pine regeneration. The forest floor is covered in patches with a thin layer of loose mull, and the nutrients obtained from the raw humus are in a form which is readily available for the young Pines. The *Vaccinium/Hypnum* stage and the *Calluna* stage are themselves wholly unfavourable for Pine regeneration, but, between the two, conditions are suitable for the establishment of young trees. This intermediate stage is only made possible by the transformation of the raw humus, its decomposition, and eventual disappearance brought about by the growth of *Vaccinium.*

11.49. Soil Types

11.49 (942) : 97.1 : 22.89 : 12.25 : 64 : 42.5. STEPHENS, C. G., CROCKER, R. L., BUTLER, B., and SMITH, R. **A soil and land use survey of the Hundreds of Riddoch, Hindmarsh, Grey, Young, and Nangwarry, County Grey, South Australia.** *Bull. Coun. sci. industr. Res. Aust.* No. 142, 1941. pp. 55 + plates + maps.

For the purposes of this report the region under consideration was divided into 8 categories of land use, of which the last two are (1) natural forest largely of *Eucalyptus baxteri* and *E. obliqua,* and (2) forest plantations of exotic species, almost entirely *Pinus* spp. and principally *P. radiata.* These plantations cover some 90,000 acres under both Government and private control. The present output is nearly 10 million super. ft. of milled timber annually, and as there are large areas of young trees this figure must increase rapidly. The survey was undertaken to provide a basis for experimental work in the forestry plantations on what appear to be minor element deficiency diseases, and for land selection and soil-type control in plantation programmes.

The plantations are largely confined to the so-called 'ranges', ancient coastal dunes which run in a series parallel to the coast, with flats between them. In addition, they now include a fairly large area on the transition soil (Wandilo sand) and lesser areas on the Kalangadoo and Riddoch sands, and an increasing area on the Tantanoola flinty sand. Yields of milled timber from stands of trees about 25 years old vary from about 40,000 to 120,000 super. ft. per acre. The fact that *Pinus radiata* and other exotic species are grown successfully on the soils of the ranges points to their adaptation to poor soils. However, *P. radiata* grows consistently better on the transitional sands, Wandilo sand and the Tantanoola flinty sand, indicating that it is not growing under optimum soil conditions on the sandy range soils. Apart from the relatively small amounts of the major nutrient elements such as phosphorus, nitrogen and potash, in the range soils, the less vigour and greater incidence of such diseases as die-back, dead-top, rosetting, needle-fusion, and short-needle among the trees, may be due to an impoverished minor element status in these soils.

It was observed that the growth of trees on land which had been under rough grazing was more vigorous than on the same soils cleared and planted from the virgin state. The enhanced vigour of the trees on such sites, and on certain volcanic soils, is associated with increase in limb size (and hence larger knots), larger annual rings, more highly tapered trunks, and hence a decrease in timber quality. On some of the poorer soils, on the other hand, these undesirable features are reduced to a minimum, and consequently, though volume of growth may be slow, timber quality will be high. On a longer rotation some of the poorer soils may, therefore, have a distinct value as producers of high-class timber.

11.49 (94). PRESCOTT, J. A. **A soil map of Australia.** *Bull. Coun. sci. industr. Res. Aust.* No. 117, 1944. pp. 15 + map.

11.6. *Hydrographical Conditions. Water and Soil Conservation*

11.62 : 24.36 : 60.32 : 91.3. DUNFORD, E. G. **Proper timber cutting increases supply of irrigation water from mountain slopes.** *Colo. Fm. Bull.* 6, 1944 (10–2).

The study described in this note has been in progress for 6 years at the Fraser Experimental Forest, situated on the headwaters of the Colorado River. Annual measurements of precipitation and water losses have been made on a series of plots of Lodgepole Pine on which trees were removed in four different degrees of cutting. The heaviest cutting left only trees under 10 in. in diameter, while the lightest left 6,000 bd. ft. of commercial timber per acre (about one half of the original stand). The two intermediate cuttings left stands of 4,000 bd. ft. and 2,000 bd. ft. respectively. A series of uncut plots was also studied to show how much water is lost in a virgin forest.

In the period after cutting, the average annual precipitation was about 23½ in. Of this amount, 22 in. reached the ground in the heavily cut-over plots and only 16⅝ in. on the uncut plots. Losses by transpiration and by evaporation from the snow surface in the heavily cut plots amounted to 8 in., leaving 14 in. available for stream-flow compared with 10⅝ in. available on the uncut plots.

In terms of area, therefore, there will be about as much water available for stream flow from 3 acres after heavy cutting as from 4 acres before cutting. Intermediate gains in water yield were indicated from the 3 other treatments, in proportion to the amount of timber removed. The lighter cuttings, while resulting in smaller savings of water, are essential in areas susceptible to moderately high rates of run-off and erosion, and in areas of high danger from these causes, any timber cutting may be undesirable.

The experiments are to be continued for several years in order to obtain additional evidence.

11.62.11 : 91.3 : 60.32 : 23.21. KIRWALD, E. Forstliche Wasserhaushaltstechnik in gefährdeten Mittelgebirgslagen. Untersuchungen über Rutschungen und deren Bekämpfung im Altvatergebirge. [**The forest technique of water management in threatened mid-mountain areas. Investigations on landslides and their control in the Altvatergebirge.**] *Thar. forstl. Jb.* 93, 1942 (429–519). [G.g.]

Natural devastation cannot be entirely prevented, but its frequency and extent can be materially reduced. Where the tendency to such devastation exists, even small disturbances in the balance of nature may be decisive factors. The causes of such disturbances should be determined and controlled.

Large-scale soil erosion can often be transformed into harmless and insignificant run-off by the help of forests, while at the same time the water economy of the region is permanently improved.

In order to obtain favourable effects in the water economy of a region the following conditions are necessary: (1) a stratified penetration of the soil space by the plant roots and a ground cover and soil structure favourable to infiltration; and (2) a re-introduction of woody species suited to the site, supplemented by trees and shrubs of value in water management such as Mountain Ash, Green Alder and Grey Alder.

11.62.11 (56.43) : 97.1. WATERER, R. R. **The problem of soil erosion and its control in Cyprus.** The Middle East Agricultural Conference, Cairo. 1944. pp. 4.

Cyprus is a typical example of a Middle-Eastern territory in an advanced state of erosion caused by centuries of bush clearance, imprudent cultivation and over-grazing. Remedial measures suggested are contour-trenching and terracing of cultivated land, effective control of grazing, which has been uncontrolled except in some of the more important state forests, and the compulsory substitution of mineral for wood fuel. Reforestation could then be carried out. The Cyprus Government has now set up a Land Utilization Committee, for the purpose of advising what measures should be adopted in order to secure better land utilization and so arrest and control erosion.

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11.1. *Metabolism. Plant Constituents. Sap Flow. Growth Substances. Reserve Materials*

12.11.1 : 12.25 : 12.21. BOSE, S. R. **Suspected symbiosis in *Casuarina equisetifolia* tree.** *Abstr.* in *Proc. 30th Indian Sci. Congr.* Part 3, 1943 (45). L.S.

A fungus of weak virulence (believed to be a member of the Ascomycetes group) has been found living intracellularly in the cells of roots, stems, green branchlets, fruits and seed-coats of normal and healthy *Casuarina* plants. A close connexion has been observed between hyphal occurrence and the presence of tannin. Experiments on the germination of *Casuarina* seeds in the presence of the fungus in pure culture are now in progress.

12.11.11 : 12.26–8 : 33.39. ROVESTI, G. **The alcohol yield from some Italian plants.** *Riv. ital. Essenze* 24, 1942 (183–203). *Chem. Zbl.* I, 1943 (575). Chem. Abstr. 38 (3083). P.R.

The compositions of *Arbutus unedo*, *Aesculus hippocastanum*, *Arum maculatum*, *Asphodelus ramosus* L., *Myrtus communis*, *Sorbus aucuparia* and *Opuntia ficus-indica* are given, and the possibilities of producing alcohol from them are discussed.

12.11.11 : 12.25 : 34.26. RUZICKA, L., SCHINZ, H., and MÜLLER, P. H. **Sesquiterpenes LXII. A new type of sesquiterpene from *Cedrus atlantica* leaf oil.** *Helv. chim. Acta* 27, 1944 (195–206). Chem. Abstr. 38 (4582–3). P.R.

12.11.11 : 12.26–8. SÄVERBORN, S., and DANIELSSON, K. E. **Globulin in Horse Chestnut.** *Svensk kem. Tidskr.* 55, 1943 (155–9). Chem. Abstr. 38 (5536). P.R.

A globulin was isolated from *Aesculus hippocastanum* and the name suggested for it is hippocastanin. Analytical data are given.

12.11.11 : 01.4. GRIFFITH, R. B., and JEFFREY, R. N. **Determining chlorophyll, carotine and xanthophyll in plants.** *Industr. Engng. Chem.* (*Anal. Ed.*) 16, 1944 (438–40). [Kentucky Agricultural Exp. Sta., Lexington, Ky.] P.R.

A method for the determination of chlorophylls *a* and *b*, carotene, and total xanthophyll from a single ether solution is described.

12.11.11 : 12.14.5 : 12.26–8. CHARAUX, C., and RABATÉ, J. **The CHCl$_3$ complex of Aspen leaves. Salicyloylpopuloside and salicylic salicoside.** *J. Pharm. Chim., Paris* [9], 2, 1942 (289–303). *Chem. Zbl.* 1942, II (2599–600). Chem. Abstr. 38 (2327–8). P.R.

12.11.11 : 12.25 : 12.26–8. LEMESLE, R. **On the occurrence of tannin-mucilage complexes in certain phanerogams (*Ginkgo biloba* L. and some species of *Myristica*).** *Bull. Soc. bot. Fr.* 88, 1941 (424–7). Chem. Zbl. II, 1943 (1809). D.S.I.R.

12.11.2. *Propagation. Growth. Development*

12.11.2 : 12.26–8. RICHARDS, A. V. **Studies in propagation of Sapodilla.** *Trop. Agriculturist, Ceylon* 99, 1943 (78–82 + plates). L.S.

Trees of Sapodilla (*Achras zapota*) grown from seed normally take 6 to 8 years to come into bearing, but layered and grafted plants flower within about half that period. In addition to seedling Sapodilla (which makes good, compatible stock but is slow-growing) the root-stocks used are *Madhuca* (*Bassia*) *longifolia* and *Manilkara* (*Mimusops*) *hexandra*. The former stock often appears to outgrow the scion in girth after 4 or 5 years, so causing sudden die-back. There is no evidence of incompatibility in the case of Sapodilla bud-grafted on *M. hexandra*, a relatively slow-growing species which is also more drought resistant than *Madhuca longifolia*.

12.11.21 : 12.26–8 : 12.11.3. PFEIFFER, N. E. **Prolonging the life of *Cinchona* pollen by storage under controlled conditions of temperature and humidity.** *Contr. Boyce Thompson Inst.* 13, 1944 (281–93).

Experiments undertaken to determine conditions likely to prolong the life of *Cinchona* pollen indicate that in controlled relative humidities of 35 to 50 per cent. and at a temperature of 10° C., in darkness, an average of 5 to 19 per cent. of *Cinchona* pollen grains will retain their viability for a year. Storage in a vacuum failed to prolong life.

12.11.21. DENGLER, A. and SCAMONI, A. Über den Pollenflug der Waldbäume. [**On the flight of forest tree pollen.**] *Z. ges. Forstw.* 76 [70], 1944 (136–55). [G.]

Investigations on the flight of forest-tree pollen are of importance (1) for pollen analysis, to establish transport distances and the quantitative relationship between the pollen of different species; (2) for research on provenance, to assess the possibility of race mixtures through the introduction of pollen from other districts; and (3) for the ecology of pollination and fertilization, to determine the conditions under which both processes take place.

After a discussion on the phenomenon of 'pollen rain' and on various methods of collecting pollen, the results are given of experiments carried out in eight widely-separated parts of Germany in the spring of 1931. Data are given on the actual and proportional amounts of pollen of various species (Beech, Oak, Spruce and Pine) collected in the different areas. As these represent conditions obtaining in one year only, they cannot be regarded as more than indicative, but they open the way for further research. Pollen flight is dependent upon various factors including the weather, the strength and direction of the wind, vertical air currents, and the rate at which the pollen falls.

12.11.22 : 12.26–8. GULLÖVE, F. H. Über die vegetative Vermehrung von *Populus tremula* L. [**On the vegetative propagation of *Populus tremula* L.**] *Züchter* 15, 1943 (101–4). [G.] [Institut für Laubweichholz- und Cellulosepflanzensüchtung, Karlsruhe.] C.G.B.

Description of an experiment on the vegetative propagation of *P. tremula* and the important hybrid *P. canescens* (= *P. alba* × *tremula*) by cuttings, using the proprietary growth substance 'Eurit'. Results showed that these species can be successfully propagated by cuttings. Cuttings with leaves showed a higher rate of survival than defoliated cuttings, although the latter were generally quicker in striking root.

12.11.23 : 12.14.4 : 12.26–8 (76.3) : 21.2. BONCK, J., and PENFOUND, W. T. **Seasonal growth of twigs of trees in the batture lands of the New Orleans area.** *Ecology* 25, 1944 (473–5).

During the 1943 growing season a study was made of twig elongation in 4 species on the batture of the Mississippi River at Audubon Park in New Orleans. Measurement of twigs on Sandbar Willow (*Salix interior*), Black Willow (*S. nigra*), Pecan [*Hicoria* (= *Carya*) *pecan*], and Hackberry (*Celtis mississippiensis*) were made at approximately weekly intervals. During the season there were two flood periods, one from 3rd April to 26th April, and a later and greater flood from 22nd May to 10th July. Perhaps the most important information derived from this study was the fact that all species showed remarkable growth during floods when the ground was covered with as much as 4 to 7 ft. of water for long periods. This is particularly noteworthy since neither Hackberry nor Pecan is a hydrophytic species. *From authors' summary.*

12.11.23 : 07.7 : 12.14.3. GOODYEAR, H. E. **The exposure meter as a root-measuring device.** *J. For.* 42, 1944 (765).

A device for measuring root development of cuttings makes use of a photo-exposure meter which measures the amount of light, from a fixed source, intercepted by the roots.

12.11.3. *Breeding. Races and Questions of Provenance*

12.11.3 : 12.11.22 : 12.11.23. JENSEN, H. Modern teknik vid växtförädling med träd och buskar. [**Modern technique in plant improvement with trees and shrubs.**] *K. Lantbr. Akad. Tidskr.* 82, 1943 (330–40). [Sw.g.] E.M.B.

Various ways of accelerating the developmental rhythm of trees and shrubs and of inducing early and abundant flowering are fully discussed, with notes on the writer's own experiments. Some specific reactions of different genera and species as well as of individual trees are mentioned.

The relative values of bark ringing and strangulation and of root pruning and transplanting are considered at some length, and the use of dwarf stocks to induce flowering is also discussed. Suitable dwarf forms, abnormally early and prolific in flowering, of some of the more important trees (Pine, Spruce, Oak, Ash and Birch, etc.) are available and could be used as stocks in breeding operations. With the same object grafts have been tried using different species as the stock, e.g. grafts of different types of Aspen upon the very vigorous *Populus trichocarpa*, all of which flowered at 2 to 3 years. Grafts of pronouncedly long-day Aspen on Grey Poplar (Gråpoppel) stocks of southern provenance have produced annual shoots about 3 m. long and are growing vigorously, in contrast to Aspens from the same mother tree which, growing from their own roots on the same soil, showed annual shoots a few decimeters long. This technique could be used to obtain more and better seed from extreme northern forms moved to southern districts.

In order to eliminate differences in length of day requirements and to induce early and profuse flowering, grafts have been made in the greenhouse, scions from many élite Pines from different climatic regions of Sweden being grafted upon stocks of the small southern *Pinus montana*. Similar work (involving over 1,000

grafts) has been done *inter alia* with élite common Spruce (*Picea abies*) grafted on *P. alba*.

Wettstein's method of crossing Poplars by using flowering branches placed in water has been extensively applied to this genus at Ekebo, while for other genera the growing of small but prolifically flowering specimens in pots for use for controlled crosses in greenhouse has been preferred. Difficulties of grafting on species other than Elm, Ash and Poplar have been successfully solved by the old bottle grafting method, tried first on Birches and later (with necessary modifications) on other species of trees. Incidentally, vitamin B_1 in the water in the flask seems to promote union.

This method has been used successfully to preserve the valuable genotype of an élite, giant-type Spruce, that had been cut down by mistake and lain for five months buried in snow. The process is also being tried with other genetically valuable trees in similar circumstances.

Discussing polyploidy in conifers, the author refers to the record of a tetraploid *Sequoia sempervirens* and to Syrach-Larsen's triploid hybrid from a cross of *Larix europea* and *L. occidentalis*.

Colchicine treatment of a large amount of seed has resulted so far in two tetraploid forms confirmed by Leva, one of *Thuja gigantea* and one of *Sequoia gigantea*; both these forms are described in detail. Judged by their external appearance, the five aberrant *Thuja gigantea* trees could have been taken for some southern Cypress. The tetraploid plants of *Sequoia gigantea* (from seed from America) compared with diploid controls showed a definite increase in vigour, larger and coarser, almost succulent needles, thicker branches, and a darker blue green colour.

Colchicine-treated Spruce, Pine, Larch and Douglas Fir have not yet been cytologically examined, but it is suggested that triploid and tetraploid forms of conifers may well occur spontaneously, especially among forms with the typical characteristics of polyploidy, such as needles longer and thicker than normal, thicker branches, and greater vigour than usual. A survey of such forms should be made, followed by cytological examination.

Among the numerous deciduous tree species in which polyploids are recorded is *Prunus laurocerasus* with 144 chromosomes (i.e. 18 times the basic number 8).

12.11.3 : 61.31 : 12.25 (485). [Sylvén, N.] Inventering av elitgranbestånd. [**Survey of élite Spruce stands.**] *Skogsägaren* 18, 1942 (184–7). [Sw.]

For use in connexion with the Spruce survey in Sweden, information is given on (1) the well-known characteristics of the Spruces and the comb Spruce in particular, and the inheritance of the comb habit; and (2) the way in which the survey of élite stands and trees is to be carried out. M. L. C. W.

12.11.3 (71). **Forest tree breeding.** *Aust. Timb. J.* 10, 1944 (232, 235).

In 1938 a tree-breeding programme was inaugurated in Canada under the combined authority of the National Research Council, the Department of Agriculture and the Dominion Forest Service for the purpose of forest conservation and tree breeding. The aims of this programme were: (1) the production of easily-propagated rapid-growing high-quality trees for use in shelterbelts, woodlots and forests; (2) the production of new hybrid forms possessing superior qualities of disease resistance; (3) the improvement of propagation methods to meet the requirements of commercial forestry; (4) studies of plant diseases and their control; and (5) improvement of naturally regenerated forests.

Vegetative propagation of first-generation hybrids and the production of new forms through chromosome doubling (e.g. by colchicine treatment) are means by which the time element in tree breeding work may be effectively reduced. The importance of choosing good planting stock for purposes of afforestation is emphasized, since the failure of many plantations has been due to the use of poorly adapted species or races of trees.

12.14. Organography. Morphology. Anatomy. Histology

12.14.3 : 12.26–8 : 21. Day, M. W. **The root system of Aspen.** *Amer. Midl. Nat.* 32, 1944 (502–9).

The root systems of a large number of Aspen (*Populus tremuloides*) seedlings growing on different sites, were excavated in part or entirely, and examined; this study was made at the Dunbar Forest Experiment Station near Sault St. Marie, Michigan.

On moist sandy soil the root system of seedlings was usually strongly lateral with fine fibrous roots; by the second year the main laterals had extended from 4 to 6 ft. and suckers had appeared. On podsolic soils with a dense hardpan the development of sucker roots was correlated with the presence of old roots and root channels in the soil.

One tree 18 years old and 25 ft. high had a main lateral root 47 ft. long with branch sucker roots reaching a vertical depth of 7½ ft.; this lateral root had eight suckers directly on it and many more on the branch roots.

The rooting and suckering ability of Aspen are important factors in relation to the silvicultural treatment of this species.

12.14.4 : 12.26–8. Nast, C. G. **The comparative morphology of the Winteraceae VI. Vascular anatomy of the flowering shoot.** *J. Arnold Arbor.* 25, 1944 (454–66 + plates).

The present paper is devoted to 'an examination of the pedicellar and toral vascular systems' of the Winteraceae as illustrated by species of the genera *Drimys*, *Bubbia*, *Pseudowintera* and *Belliolum*. After a preliminary section dealing with terminology the author discusses the structural forms assumed by the inflorescence, pedicel, calyx, petal, stamen and carpel in various sections of the family.

12.14.4 : 12.26–8. Boureau, É. Les faisceaux de la plantule de *Mercurialis annua* comparé à ceux des plantules des Gymnospermes. [**The vascular bundles of the seedling of *Mercurialis annua* compared with those of Gymnosperm seedlings.**] *C.R. Acad. Sci. Paris* 214, 1942 (959–61). [F.] L.S.

The pseudo-excentric arrangement of the vessels observed at a certain stage in the vascular development of *Mercurialis annua* is comparable with that of the vessels in the hypocotyl of young Gymnosperms (*Libocedrus*, *Thuja*, *Pinus*, etc.) but does not necessarily represent the same phase in vascular evolution.

12.14.5 : 12.26–8 : 12.11.23 : 21.11. Isahogle, I. T. **Effects of controlled shading upon the development of leaf structure in two deciduous tree species.** *Ecology* 25, 1944 (404–13).

Cornus florida rubra and *Acer platanoides* were used

in experiments to determine the effect of different light intensities upon leaf structure. One bud of a pair of opposite buds was enclosed in a cheesecloth-covered compartment and the other was exposed to full sunlight. The compartments were covered with 1, 2, 4, and 6 layers of cheesecloth, which transmitted 70, 48, 22, and 10 per cent. of full sunlight respectively. At intervals leaf samples were taken and studied to determine the effect of differences in light intensity on both cell division and cell elongation.

Cell divisions took place in both planes in the development of mature leaves from embryonic leaves in both species, even when the light intensity was reduced 90 per cent. Cell divisions which resulted in additional cell layers in mature leaves were equal, so that all comparable shaded and unshaded mature leaves of the two species had the same number of cell layers. Cell divisions which increased the number of cell layers in leaves of *Cornus florida rubra*, from that of the embryonic leaf to that of the mature leaf, occurred before the leaves were 2 cm. long. Since the number of cell layers found in shaded and unshaded leaves of the two species were the same, differences in light intensity did not affect this process. However, anticlinal cell divisions in the plate meristems responsible for the expansion of the leaf blade in area were fewer under reduced light intensities in both species than under full sunlight.

Mature shaded leaves of both species were smaller in area and thinner in cross section than leaves from opposite unshaded shoots. This difference was, to a large extent, due to less elongation of the cells of the shaded leaves. All the anatomical differences found in cross section and most of the differences in areas of leaves were the results of variations in cell elongation. Differences in light intensity did not equally affect cell elongation in both planes during development. Light intensity has the greatest influence upon elongation of cells in both planes after the leaves are 3 cm. long. *Author's summary.*

12.14.5 : 12.25. DOSTÁL, R. Zur experimentellen Erzeugung der Trennungsschicht an den *Taxus*-Nadeln. **[On the experimental production of the separation layer in *Taxus* needles.]** *Planta* 33, 1943 (558–75). [G.] O.B.D.

Formation of the separation layer in *Taxus* needles can be brought about by various factors, including illuminating gas, a fairly high temperature (29–30° C.), and mutilation of the needles (shortening to 3–5 mm.). Heteroauxine has a strongly inhibiting effect on the formation of the separation layer, while aneurin tends to hasten the detachment.

12.14.5 : 12.11.11. SEYBOLD, A. Zur Kenntnis der herbstlichen Laubblattfärbung. **[On the autumn coloration of foliage leaves.]** *Bot. Arch.* 44, 1943 (551–68). [G.] Chem. Zbl. II, 1943 (2244–5). D.S.I.R.

The author discusses the behaviour of leaf pigments during autumn coloration in relation to the disintegration of the plastids.

12.14.6. KITTREDGE, J. **Estimation of the amount of foliage of trees and stands.** *J. For.* 42, 1944 (905–12). [Univ. of California, Berkeley, Calif.]

This paper, based on American and European data, shows how the weight of foliage of a tree or stand may be estimated either from periodic annual growth or the diameter of the trees concerned. The relation between leaf-weight and diameter is the more useful of the two and appears to be applicable to trees of different sizes, crown classes, and ages, at least up to the age of culmination of growth, and beyond that age for tolerant species in all-aged stands.

The relations between leaf-weight and periodic annual growth is a simple linear regression of the form $W = bi - a$ where W is the dry leaf weight, i the periodic annual increment in ft. and b and a are constants (slope and Y-intercepts) which must be determined from leaf weights and growth of a certain number of sample trees of the species in question.

For the relations to diameter, the regression in logarithmic units is linear and has the form $\log W = b \log D - a$, where D = diameter and b and a are again constants to be determined for the species and site.

A table gives a summary of values of the slopes (a) and the Y-intercepts (b) for different localities, sites and ages for Ponderosa Pine, White Pine, Douglas Fir, Red Pine, Canyon Live Oak, Jack Pine, Scotch Pine, Norway Spruce, Silver Fir and European Beech.

12.14.7 : 12.25 : 09.2. CAIN, S. A. **Size-frequency characteristics of *Abies fraseri* pollen as influenced by different methods of preparation.** *Repr.* from *Amer. Midl. Nat.* 31, 1944 (232–236).

Fresh, mature pollen grains of the southern Balsam Fir (*Abies fraseri*) were prepared by four methods for size-frequency analysis. Treatment with 95 per cent. alcohol did not significantly change the grains from the size found in comparable materials merely boiled in water. The widely used acetolysis and KOH methods of preparation of peats for pollen analysis and of 'fossilization' of fresh grains, however, result in an apparent grain swelling of 8·5 per cent., which is shown to be statistically significant.

Certain fossil *Abies* pollen grains from buried soils in the South Carolina Piedmont were shown to have size characteristics over one-fourth larger, on the average, than the eastern species of Fir, *Abies fraseri* and *Abies balsamea*. The identity of the fossil Fir remains unknown. *Author's summary.*

12.14.7 : 12.11.3 : 12.25 : 12.11.23. SPURR, S. H. **Effect of seed weight and seed origin on the early development of Eastern White Pine.** *J. Arnold Arbor.* 25, 1944 (467–80 + plate).

Seed weight is related to germination, survival, and the early size of the plant. The correlation between seed weight and shoot weight diminishes as the plant ages, but is still noticeable after three years. Seed origin is related to germination, appearance, moisture content, and seedling growth. The influence of seed origin on plant size is as strong at the end of the third year as at the end of the first growing season. *From author's summary.*

12.14.7 : 12.26–8. JOSHI, A. C. **Floral anatomy of the male flowers of *Myristica fragrans* with special references to the origin of the trimerous perianth.** *Abstr.* in *Proc. 30th Indian Sci. Congr.* Part 3, 1943 (51). L.S.

12.14.7 : 12.26–8. OZENDA, P. Sur la vascularisation des carpelles et du pistil chez les *Magnolia*. **[On the vascularization of carpels and pistil in *Magnolia*.]** *C.R. Acad. Sci. Paris* 217, 1943 (31–3). [F.] L.S.

A brief account of the vascular structure of the carpel and pistil in the genus *Magnolia*, particularly as exemplified in *M. grandiflora*.

12.19. Geographical Distribution. Plant Geography and Sociology

.19 (47.6). TAKHTADZHYAN, A. Botaniko-geogra-heskii ocherk Armenii. **[Phytogeographical survey of e Armenian Soviet Republic.]** *Trud. bot. Inst. Armfan* ol. II, 1941. pp. 180. [Russ.e.] O.B.D.

After tracing the developmental history of the flora of rmenia and the adjoining countries, the author divides e area into phytogeographical districts and briefly dicates the most characteristic endemic species in ch. The main vegetation types found in Armenia e: (1) Alpine, (2) subalpine, (3) forest, (4) mountain-eppe, (5) xerophilous mountain, (6) ephemeral-saline egetation of the tertiary red clays, (7) psammophilous egetation of the alluvio-proluvial deposits, (8) sage-ush semi-deserts, and (9) halophilous and hydro-ilous vegetation of the alluvium of Arax. The rest vegetation is represented by the predominantly eech (*Fagus orientalis*) forests of northern Armenia, e xerophytic remains of Oak forests in southern rmenia, the mixed forests (largely Oak, Elm, Maple id Ash) of Zangezur, and the sparse Juniper wood-nds characteristic of some xeric mountain regions of e south.

.19 (485) : 23.21. KOCH, W. La phytosociologie et forêt. **[Phytosociology and the forest.]** *J. for. suisse* , 1944 (198–204, 228–34, 249–55). [F.] [Institut de otanique systématique de l'E.P.F.]

Although the lower slopes in north-east Switzerland e covered mainly with Beech forest, many associations ay be distinguished. Details are given of some of ese, such as *Fagus/Luzula nivea*, *Fagus/Dentaria* and *gus/Vaccinium myrtilla*. At the upper limit of the eech zone is found a sub-association of *Abies pectinata* aracterized by shrubs and herbaceous plants from e sub-alpine Spruce forest. The Sycamore/Ash and sh/*Carex remota* associations are found on deep ayey soils, in ravines and on marls at the base of opes; the Alder/*Carex elongata* association occurs on arshy sites. The three main Pine associations that ay be distinguished are *Pinus sylvestris/Molinia lito-lis*, *Pinus* spp./*Carex humilis* and *Pinus* spp./*Erica*, hich are all relic associations as are the Oak/*Litho-ermum*, Oak/Birch and Lime/*Asperula taurina* associa-ons. The associations found in the sub-alpine Spruce rest have not yet been investigated in detail.

The conclusion to be drawn from this study is that e artificial extension of Spruce to the lower areas aracterized by a climax forest of Beech, should be opped, since it leads to deterioration of the soil; and at a judicious mixture of deciduous species, based n natural associations, should be the aim of forest anagement.

.19 (54 : 59.1) : 12.14 : 12.2. BISWAS, K. **Systematic d taxonomic studies on the flora of India and Burma.** *oc. 30th Indian Sci. Congr.* Part 2, 1943 (101–52). L.S.

After a brief historical account of systematic and xonomic research in India and Burma the author deals ith the following subjects:—Mangrove vegetation; e vegetation of the rain forests in eastern India and uthern Burma; general features of the vegetation of e eastern Himalayas; different elements of the Indian ora; the scope of systematic and taxonomic studies in dia and Burma; the standard of work in systematic otany; and modern trends in systematic and taxonomic udies.

12.19 : 12.25 (74.1) : 22.11. OOSTING, H. J., and REED, J. F. **Ecological composition of pulpwood forests in northwestern Maine.** *Amer. Midl. Nat.* 31, 1944 (182–210).

The results are given of a study made in 1940 in the forests of the Swift River region in Maine. Representative stands of Spruce slope, mixed Spruce/hardwoods, Spruce flat, and old-field Spruce were selected and studied intensively, each stand being analysed qualitatively and quantitatively by a series of quadrats for dominant and subdominant trees, reproduction, shrubs and herbs.

Floristically, two types of pulpwood communities exist in the Swift River region, namely, pure coniferous forests on abandoned agricultural lands and high on the slopes of mountains, and mixed Spruce/hardwood forests on the lower slopes and along the better-drained water-courses of the lowlands.

The number of hardwoods increases following diameter-limit and other forms of selective cutting, and it seems that the practice of clear cutting will best serve to preserve the forests of this region relatively unchanged in type and composition.

12.19 (76.9). MCINTEER, B. B. **Some noteworthy plants of Kentucky, II.** *Castanea* 9, 1944 (101–5).

Notes on the distribution of two groups of southern trees and shrubs in the State of Kentucky. The first group, consisting of *Ilex opaca*, *Magnolia acuminata*, *M. fraseri*, *M. macrophylla*, *M. tripetala* and *Stewartia ovata*, is found principally in the south-eastern part of the State, and the second group, consisting of *Carya pecan*, *Celtis laevigata*, *Forestiera acuminata*, *Taxodium distichum*, and *Bumelia lycioides*, in the western part. Apparently the trees of the second group have invaded from the south by way of the wet land along the rivers; since they are not limited by soil type, and since climatic conditions do not vary much in the State, it is suggested that these plants will in time invade the eastern part of the State by way of the wet land along the Ohio River and its tributaries.

12.19 (77.1) : 11.42.31. STONE, M. H. **Soil reaction in relation to the distribution of native plant species.** *Ecology* 25, 1944 (379–86).

Results from this study, which was made in a 25-acre tract of forest in Cuyahoga County, Ohio, indicate that no relationship can be shown between soil reaction and the distribution of *Acer rubrum*, *A. saccharum*, *Betula lenta*, *Fagus grandiflora*, and a number of herbaceous species. *Tsuga canadensis*, on the other hand, was found not to be independent of the pH value of the soil within the range investigated.

12.19 (941) : 12.26–8 : 11.2 : 11.48–9. GARDNER, C. A. **The vegetation of Western Australia with special reference to the climate and soils.** *Repr.* from *J. roy. Soc. W. Aust.* 28, 1941–42 (xi–lxxxvii).

There are two main elements in Australian flora, an ancient Antarctic element derived from a southern source, and a possibly more recent Palaeotropic element which has migrated to Australia by way of India, Malaya and Melanesia. A third (Australian) element, has been postulated, and though its size has been overestimated, there does appear to be evidence for its existence and possibly for its origin in South-Western Australia where alone it has maintained its floristic stability.

Western Australia may be divided into three

provinces of vegetation and climate:—(1) *The Northern Province*, with summer rainfall and winter drought, and precipitation in excess of 175 mm. for the four wettest consecutive months (December–March or January–April). (2) *The South-west Province*, with winter rainfall and summer drought, and precipitation in excess of 175 mm. for the four wettest consecutive months (May–August). (3) *The Eremean Province* with less than 175 mm. rainfall for the four wettest consecutive months. In the northern part of this area the four wettest months are January–April, in the southern part May–August. The middle region has its maximum precipitation between March and June, the two wettest months being March and June.

(1) *The Northern Province* is characterized by the Indo-Melanesian element of vegetation, by its formations in which grass takes a predominant part as the most important ground flora, and by the predominance of megathermic plants. Except in the riverain and Mangrove formation, grass occurs almost everywhere. Sclerophyllous shrubs are absent or scarce, and trees are usually sparsely distributed. In the southern dry areas *Triodia* steppe and Mulga-bush occur, with savanna on the alluvial soils. Only where laterite is present is there any sign of sclerophyllous formations, and these are distinguished by frequent occurrence of palms and broadleaved shrubs. Apart from the Mangrove formations which fringe the coast, the real home of the Indo-Melanesian element of vegetation is in the riverain forests where, under the influence of telluric water, species which are more properly those of the rain forest find a suitable environment, independent of atmospheric precipitation. The monsoon woodland occurs in the higher rainfall areas and is most highly developed on the sandstone. Apart from *Eucalyptus* species there are a number of Indo-Malayan trees, many of them deciduous. The savanna woodland, of which there are two types, the basaltic and the sandstone, extends southwards to the Fitzroy River and has much in common with the monsoon woodland, but is much more open in composition, with a greater abundance of perennial grass, and *Eucalyptus* plays a more important role.

(2) *The South-west Province* is distinguished floristically by the rich development of the Australian and Antarctic elements. Another characteristic is the predominance of sclerophyllous shrubs in every formation, either as undergrowth in the forest and woodland or crowding the heaths. The floristic wealth of these heaths is probably unparalleled elsewhere. The paucity of herbaceous plants, especially grasses, is also noteworthy. Lastly, it is the high degree of endemism (about 80 per cent.) within the Province, which is one of its outstanding characteristics. Apart from the littoral halophytic and dune formations, the south-west formations are mainly woodland and heath types. The 500 mm. and 200 mm. seasonal isohyets divide the Province into three parts characterized respectively by forest, savanna woodland and sclerophyllous woodland.

(*a*) The forest formations:

(i) Jarrah forest, on lateritic soils, consists mainly of *Eucalyptus marginata* with some *E. patens* and *E. calophylla*.

(ii) Karri forest is sharply contrasted with the Jarrah forest by its larger trees (*Eucalyptus diversicolor*, *E. jacksoni*, *E. guilfoylei*, and *E. calophylla*), mesophytic undergrowth and the better development of an understorey of trees. It occurs on soils developed from granitic or gneissic rocks and is really a type of temperate rain forest.

(iii) Tuart forest is a type of savanna forest in which the trees of Tuart (*Eucalyptus gomphocephala*), attaining a height of 40 m., dominate the forest in almost pure stands. It is edaphically confined to the limestone of the western coastal plain.

(*b*) The woodland formations:

(i) Savanna (temperate) woodland of Wandoo (*Eucalyptus redunca* var. *elata*) occurs on the granitic soils of the Jarrah forest of the Darling Range.

(ii) Sclerophyllous woodland on the loamy soils near the 225 mm. isohyet. These formations are everywhere limited by the edaphic factor—nowhere do they occur on sand.

(*c*) Lateritic formations:

Apart from the Jarrah forest, the lateritic formations do not support arborescent species except for two types, the Wandoo (*Eucalyptus redunca* var. *elata*) which occurs as a small tree forming open woodland with undergrowth of *Acacia* spp. and the Wodgil country in which *Acacia* is predominant.

(*d*) Formations on the granitic rocks:

There are a number of plants entirely confined to the outcrops of granite, amongst them *Casuarina huegeliana*.

(*e*) Swamp formations:

These occur in the coastal plain; in general, they are rich in annual herbs, and Myrtaceae and certain Proteaceae make up most of the shrubby and arborescent species.

(*f*) Halophytic and Dune formations.

(*g*) Sand heaths:

Wherever the soil is of a sandy nature, heath-like formations predominate.

(3) *The Eremean Province* is, floristically and ecologically, the most impoverished of the three provinces; but an interesting feature is the part played by psammophytes. Wherever the soil is sandy, there is found the autochthonous flora of the south-west, or at least its hardy psammophilous representatives.

Trees and shrubs make up the greater part of the vegetation of Western Australia. Their importance is, however, greater in those areas dominated by the winter rainfall-summer drought climate; in the South-west Province, the preponderance of shrubs is overwhelmingly great, when compared even to trees. In the South-west Province and Eremea, there is a typical growth form, which may be called *infundibular*, common in both trees and shrubs, perhaps most typically represented in *Acacia acuminata*. In this growth form, the stem, by a system of repeated upward branching, produces a multiplicity of branches and twigs, all attaining about the same height, and resulting in a flat or convex dense crown with a light covering of leaves. Seen in lateral profile it resembles a funnel with a convex apex, the branches and branchlets leafless except at the summit. As an adaptation to withstand the desiccating action of dry winds, this growth form is most effective.

12.19 (942) : 11.49.3. CROCKER, R. L. **Soil and vegetation relationships in the lower south-east of South**

Australia. A study in ecology. *Repr.* from *Trans. roy. Soc. S. Aust.* 68, 1944 (144–72 + plates).

This study is an attempt to define and delimit the principal vegetation associations in Lower South-East Australia, and to establish the edaphic and environmental factors influencing their development and maintenance. The area concerned is about 3,200 sq. miles in the Counties of Grey and Robe. The work was carried out over the period from 1937–40 and much of it was done during a soil survey.

The chief physiographic feature of the South-East generally is the unique arrangement of sand-dune ranges parallel to the existing coastline. They are often indurated and rarely more than 100 ft. high, and between them are series of flats or plains. These superimposed ranges have impeded the natural drainage to the sea, and have preserved a topography of extreme immaturity.

The soils of the area are of four main classes: (1) podsols, (2) rendzinas, (3) terra rossas, (4) volcanic soils.

The whole area receives more than 20 in. of rain per annum; most of its receives more than 25 in., and the Millicent-Kalangadoo-Mount Gambier area more than 30 in. Most of the effective rainfall occurs in the winter and spring (April–October) seasons. Because of the impeded drainage the plains are very wet in winter and early spring, and there is much swamp.

The principal vegetation formations are (1) dry sclerophyll forest, (2) heath, (3) mallee scrub, (4) savanna communities.

(1) *Dry sclerophyll forest.* The dry sclerophyll forests are somewhat open, with sparse, discontinuous grass cover, but an abundance of sclerophyllous shrubs and undershrubs. The following associations are distinguishable:—

(*a*) *Eucalyptus baxteri.* This is the association *par excellence* of all the sandy ridges. *E. baxteri* may form a canopy at about 40 or 50 ft.; below this a few tall shrubs or small trees occur, and beneath them is an abundance of sclerophyllous undershrubs and small shrubs.

(*b*) *Eucalyptus obliqua.* This association is very limited. It occurs on better soils than the impoverished sands of the *E. baxteri* association, and its climatic limit in the north is the 24-in. rainfall isohyet. Manna Gum (*E. huberiana*) is sometimes a co-dominant.

(*c*) *E. baxteri*/*E. huberiana.* On the very shallow phases of the Nangwarry Sand, *E. huberiana* often becomes sole dominant. The habitat is relatively wet, and the formation approaches savanna.

(2) *Heath.* Heath lands are best considered in relation to the sclerophyll forests, to which they give way on the better-drained, slightly higher sands. The principal associations are *Xanthorrhoea australis*/*Hakea rostrata, Melaleuca gibbosa*/*Hakea rugosa, Eucalyptus fasciculosa*/*Banksia marginata, Cladium filum*/*Melaleuca gibbosa.* These modifications of heath are due principally to edaphic factors, including water relationships. The *X. australis*/*H. rostrata* association may be considered an edaphic subclimax association of the dry sclerophyll forest. The heath associations as a whole are best regarded as an edaphic complex with some definite floristic and edaphic links with the *E. baxteri* edaphic complex.

(3) *Mallee scrub.* This formation is practically limited to a strip near the coast, which receives between 24 in. and 26 in. of rain per annum. Here, on shallow terra rossa soils, there is a typical low dense mallee scrub of *E. diversifolia* which rarely exceeds 9 ft. in height. Associated with it are a number of sclerophyllous shrubs and undershrubs, many of which are common to sclerophyllous forest and heath.

(4) *Savanna communities.* The following are the principal associations: *Melaleuca pubescens*/*Eucalyptus camaldulensis, E. ovata*/*Xanthorrhoea australis, Eucalyptus leucoxylon*/*E. fasciculosa, Gahnia trifida*/*Cladium filum.*

In the area described in this paper the relationship between soils and vegetation is for the most part remarkably clear-cut, and there are excellent opportunities for studying the effect of climate on vegetation, since the dune ranges run almost at right angles to the climatic zones and across several of them. It was found that wherever an association occurs on a modified soil or differing soil type, there is always accompanying modification in floristic composition. Soil variations can be linked with floristic variations, and separate associations linked within an edaphic complex satisfactorily demonstrate the environmental relationships.

12.19 : 12.26–8 :44.3 : 12.25. QUICK, C. R. **Effects of snow-brush on the growth of Sierra gooseberry.** *J. For.* 42, 1944 (827–32).

The greenhouse study reported in this paper confirms previous field observations to the effect that Snowbrush (*Ceanothus cordulatus* Kell.) appears to be a nurse for seedlings and small bushes of Sierra Gooseberry (*Ribes roezli* Regel), probably because of the presence of nitrogen-fixing bacteria on the roots of *C. cordulatus.* An understanding of this relationship is important to blister rust control in the Sierra Nevada, where *R. roezli* is the chief species which must be suppressed to protect Sugar Pine (*Pinus lambertiana*).

12.19.1. *Regional Floras, including Check-Lists*

12.19.1 (410) : 12.25 : 12.26–8. EDLIN, H. L. **British woodland trees.** B. T. Batsford Ltd., 15, North Audley Street, London, W.1. 1944. pp. ix + 182 + plates. Price 12s. 6d. net.

This book is designed for the use of foresters, woodmen, forestry students and field naturalists, as well as the lay public which requires a concise and attractively illustrated account of the various tree species to be found in British woodlands. It bridges the gap between popular works which contain no information on the cultivation of the trees they describe and advanced technical works which are priced beyond the reach of most readers.

The method of treatment is simple and comprehensive. It deals with every species of tree planted commercially in British woodlands, with all native species, and with the principal ornamental species of parkland and garden. In all, 200 species of 57 genera are included, with concise descriptions of each tree at every season of the year and stage of growth, supplemented by keys to aid identification. The method of raising each species from seed or cuttings on the scale required for forest planting is given, together with its treatment and requirements in plantations. The appearance, uses and dimensions of timbers are dealt with, and descriptions and illustrations are given of seedlings.

French, German, Welsh and Irish names are given, in addition to the English and botanical names. In the case of exotics, the names used in the country of origin are added.

The book is well illustrated. The finer details of structure of foliage, flowers and fruit are depicted in 32 full-page plates reproduced from Miller's engravings for the 6th edition of Evelyn's flora, and 21 line drawings, which together comprise 527 separate figures.

12.19.1 (51) : 12.26–8. HUI-LIN LI. **Notes on the flora of southern China.** *J. Arnold Arbor.* 25, 1944 (420–30). [Arnold Arboretum, Harvard Univ.]

The species listed are mainly from the Province of Kwangtung, exclusive of the island of Hainan. They include the following tree species: *Styrax subcrenata*, *Symplocos ernesti*, *S. kwangtungensis*, sp. nov., and *S. spathulata*, sp. nov.

12.19.1 (67.6) : 12.29. EGGELING, W. J. **An annotated list of the grasses of the Uganda Protectorate.** Govt. Printer, Entebbe. 1944. pp. 79.

12.19.1 (72) : 12.26–8. JOHNSTON, I. M. **Plants of Coahuila, Eastern Chihuahua, and adjoining Zacatecas and Durango, IV.** *J. Arnold Arbor.* 25, 1944 (431–53).

The present list includes representatives of the following genera of woody plants: *Salix* (7 spp. and 2 varieties), *Populus* (2 spp.), *Carya* (1 sp.), *Juglans* (2 spp. and 1 variety), *Ostrya* (1 sp.), *Quercus* (22 spp., 1 variety and 1 form), *Ulmus* (1 sp.), *Celtis* (3 spp. and 1 variety), and *Morus* (4 spp.).

12.19.1 (729.1). [FRÈRE] MARIE-VICTORIN, and [FRÈRE] LÉON. Itinéraires botaniques dans l'île de Cuba (deuxième série). **[Botanical excursions in the Island of Cuba (second series).]** *Contr. Inst. Bot. Univ. Montréal* 50, 1944. pp. 410. [F.] *Abstr.* in *Trop. Woods* No. 80, 1944 (16).

This paper, the second of a series on botanical excursions in Cuba, covers the work of collecting and exploring done during 1940, 1941, and 1942. Although much of the material is new, certain chapters treat regions already studied in the first volume, giving additional information and data not previously recorded. Various corrections and adjustments in the nomenclature of certain species mentioned in the first volume have been added, either in the main body of the text or in marginal notes in the index.

12.19.1 (75.5). ALLARD, H. A. **An analysis of the flora of the Bull Run Mountain region of Virginia using Raunkiaer's 'life-form' method.** *J. Wash. Acad. Sci.* 34, 1944 (112–9). [U.S. Bureau of Plant Industry, Soils and Agricultural Engineering.] L.S.

The author outlines the fundamental principles involved in the method first used by C. Raunkiaer in 1908 for constructing a biological spectrum of the world's flora. Raunkiaer regarded the plant as a concrete, living expression of the entire climatic complex, and he based his classification of plant forms on the position of the perennating buds as being indicative of plant adaptation during the most unfavourable season. His main plant groups were: (1) phanerophytes, where the dormant buds are wholly exposed to the air; (2) chamaephytes, where the dormant buds are on the surface of the ground or not more than 10 in. above it; (3) hemicryptophytes (buds in the upper layer of the soil near the surface); (4) cryptophytes (dormant structures entirely buried more or less deeply below the soil surface); (5) hydrophytes (perennating structures beneath the water) and therophytes (plants living only one season).

The author compares the biological spectrum of the Bull Run area with Raunkiaer's normal world spectrum. The greatest discrepancy between the two is shown by the hemicryptophytes which represent 51·7 per cent. of the flora of the Bull Run area as compared with 26 per cent. of the normal spectrum. This reflects the favourability of the climate of the eastern portions of the United States to plants of the hemicryptophytic type.

12.19.1 (76.4). HINCKLEY, L. C. **The vegetation of the Mount Livermore area in Texas.** *Amer. Midl. Nat.* 32, 1944 (236–50).

This article embodies the results of an intensive survey of the vegetation of Mount Livermore and its immediate vicinity, carried out at intervals between September 1934 and October 1939. There is an average annual precipitation of at least 25 in. on Mount Livermore. The vegetation on the north slope is a part of the Petran montane forest. Most of the area belongs to the Oak woodland or to various combinations of *Pinus*/*Juniperus*/*Quercus* groupings. Some of the canyons have their own characteristic vegetation.

12.19.1 (88) : 02.41 : 34.2. STAHEL, G. **Notes on the Arawak Indian names of plants in Surinam.** *J. N.Y. bot. Gdn.* 45, 1944 (268–75, 278–9).

These notes include miscellaneous information on the uses made by the natives of Surinam of various trees and herbs.

12.19.1–2 (76.4) : 97.3. BUECHNER, H. K. **The range vegetation of Kerr County, Texas, in relation to livestock and whitetailed deer.** *Amer. Midl. Nat.* 31, 1944 (697–743).

12.19.2. *Forest Types*

12.19.2 (47.4). MALLNER, F. Vorgeschichte und Werdegang des lettländischen Waldtypensystems. **[The past history and future prospects of the Lettish system of forest types.]** *Z. ges. Forstw.* 76 [70], 1944 (105–36). [G.]

A review, mainly from Russian and Lettish literature, of the development of the Lettish system of forest types based on the structure of the plant associations of which they are composed. Data are included on the main types of forest associations, the dominant tree species present in each and their yield, the soil characteristics of the site, and the ground cover and undergrowth. The use of the forest-type system of classification on an inter-state basis is strongly recommended.

12.2. *Special (Systematic) Botany*

12.21. Fungi

12.21 : 31.3 : 12.25. RENNERFELT, E. Undersökningar över toxiciteten emot rötsvampar hos tallkärnvedens fenoliska bestandsdelar. **[Investigations on the toxicity to rot fungi of the phenolic components of Pine heartwood.]** *Medd. Skogsförsöksanst. Stockh. 1942–43* 33, 1944 (331–64). [Sw.g.] R.A.M. 23, 1944 (465).

Lentinus squamosus, *Polyporus marginatus* and *Polystictus versicolor* succumbed to 0·02 per cent. pinosylvin and *Coniophora cerebella* (*C. puteana*), *Corticium laeve* and *Trametes* (*Fomes*) *pini* to 0·01 per cent., whereas *Stereum purpureum*, *Polyporus vaporarius* (*Poria vaporaria*) exposed to 0·01 per cent. were still viable on

transference to malt agar. At 0·02 per cent. pinosylvin monomethylether was toxic to *Polyporus marginatus* and *P. vaporarius*, at 0·01 per cent. to *Stereum purpureum*, and at 0·002 per cent. to *Coniophora puteana*, whereas *Corticium laeve*, *F. annosus*, *L. squamosus*, *Polystictus hirsutus*, *P. versicolor*, *Schizophyllum commune*, and to a lesser degree *F. pini* were more resistant to this compound. Pinosylvin dimethylether was less toxic than either pinosylvin or its monomethylether, which were considerably more toxic than phenol.

The behaviour of *F. pini* in small-scale tests on impregnated Pine heartwood blocks was anomalous, its growth under these conditions being practically unimpeded in contrast to its rapid collapse in the presence of the phenolic substances in pure culture.

12.21. BIRKINSHAW, J. H., BRACKEN, A., and FINDLAY, W. P. K. **Biochemistry of the wood-rotting fungi. 4. Metabolic products of *Trametes suaveolens* (Linn.) Fr.** *Biochem. J.* 38, 1944 (131–2). [London Univ. and Forest Products Research Laboratory.] L.S.

Methyl anisate was identified as the major volatile metabolic product of the fungus *T. suaveolens* grown on aqueous malt extract. Anisaldehyde was also detected, but in much smaller amounts.

12.21 (73) : 31.42.1 : 12.26–8. DAVIDSON, R. W. **Two American hardwood species of *Endoconidiophora* described as new.** *Mycologia* 36, 1944 (300–6). R.A.M. 24, 1945 (37).

Comparisons of cultures of *Endoconidiophora coerulescens* from Europe, obtained from the Centraalbureau voor Schimmelcultures, with American isolates of this fungus, revealed consistent and significant differences. The American fungus, commonly found on green sapwood of hardwood logs and lumber in southern United States, from Virginia to Florida and Louisiana, is therefore described as a new species, *E. virescens*. It differs from the European fungus in that it is chiefly confined to hardwoods, gives off a distinctive musty odour, and some of its conidiophores have a smaller diameter at the tip. Another related species, found causing a grey mould on Chestnut Oak (*Quercus montana*) tanbark in West Virginia, is described as *E. variospora* n. sp.

12.21 : 31.42.11. BARGHOORN, E. S., and LINDER, D. H. **Marine fungi: their taxonomy and biology.** *Farlowia* 1, (3), 1944 (395–467). R.A.M. 23 (360).

In this joint paper, D. H. Linder undertakes a classification of the fungi collected in wood and cordage submerged in the sea off the United States coast. His list contains 10 new genera, 21 new species, and 2 new combinations of Fungi Imperfecti and Pyrenomycetes. E. S. Barghoorn gives the results of a physiological study of 7 of the species which were found to grow on media of varying salinity and in sea water three times the normal salinity.

12.25. Gymnosperms

12.25 : 12.11.3 : 12.14 : 31.1. LAING, E. V. **Studies on the genus *Larix* with particular reference to hybrid Larch (*Larix eurolepis* A. Henry).** *Scot. For. J.* 58, 1944 (6–32).

The hybrid Larch (*Larix eurolepis* A. Henry) is very variable, and the present investigation was undertaken with the object of determining it more exactly. The characteristics of the parents (*L. decidua* Miller, and *L. kaempferi* Sargent) were first investigated, since these species are also very variable; thereafter the characteristics of the hybrid were investigated, and the results are given in detail. It was found that two types of hybrid can be distinguished, (1) intermediate and more resembling *L. kaempferi*, and (2) resembling *L. decidua*, often so closely as to make it difficult to distinguish. The first of these types can always be recognized when it flowers as in every case the colour of the flower is red, taking after the European Larch, though the other characteristics of the tree mainly resemble those of the Japanese parent. For the identification of the second type it is necessary to take into account a combination of characteristics, which include structure of epidermis, number of cells in the endodermis, colour of roots, the resin canals of the pulvinus and the resin canals, both longitudinal and horizontal, of the stem wood, and the height of the fusiform rays.

12.25 (410) : 98.1. HOWARD, A. L. **The Scots Pine (*Pinus sylvestris*).** *Nature, Lond.* 154, 1944 (679–80).

The Scots Pine (*Pinus sylvestris*) is the most important British conifer, but, whereas it has been intensively studied and its cultivation given every scientific assistance in Norway, Sweden, Finland and Russia, it has been neglected in Great Britain, with the result that British-grown Pine has been found generally much inferior to that imported from Europe. In 1937–38 Great Britain expended £51 million on imported timber, most of it Scots Pine, from Scandinavia, the Baltic countries, Russia and Central Europe. Before 1939, British-grown Pine was used only for rough work but during the war the demand has been so great that what was once considered inferior in now regarded as of great value. Bearing in mind the vast building operations that will take place after the war, it is important that Scots Pine be planted freely in all suitable areas and reared on scientific principles, so that the quality may be improved.

12.25 (485). GEETE, E. Ormgranar och deras förekomst. **[Worm Spruces and their incidence.]** *Skogen* 31, 1944 (263–5). [Sw.]

Some descriptions of this interesting type of Spruce and its inheritance are cited from the past records of Henrik Hesselman, Nils Sylvén and Nils Klein. Somewhat more recent accounts have also been collected on the probable hybridity of this Spruce and on the incidence of some relatively large numbers together in certain districts of Sweden. Danish investigations on the subject are mentioned without details. Some illustrations are included. M. L. C. W.

12.25 (410) : 23.21. YARHAM, E. R. **The Douglas Fir in Britain.** *B.C. Lumberm.* 28, 1944 (59–60).

Descriptions are given of individual specimens of Douglas Fir grown in Britain, and it is concluded that on suitable soils the tree will grow well and attain a great size, and will prove one of the most valuable of introduced species. The timber possesses all the qualities which made it famous in the New World, and can be used for similar purposes. Douglas Fir now accounts for 12½ per cent. of all conifers planted by the British Forestry Commission.

12.25 (74.1) : 21 : 24.25. CURTIS, J. D. **Northern White Cedar on upland soils in Maine.** *J. For.* 42, 1944 (756–9).

Observations covering a period of 3 years indicate that Northern White Cedar (*Thuja occidentalis*), which seeds in on old pastures and fields in northern Maine and southern Quebec, is a valuable timber crop, particularly for farms, if it can be effectively managed.

This paper describes some of the silvicultural characteristics of, and possible sources of damage to, this species, and gives the results of a thinning experiment aimed at increasing production; crown and selection thinning methods were used.

12.26–8. Dicotyledons

12.26–8 : 12.19. RAIZADA, M. B. **Distinguishing characters and distribution of *Acacia catechu* and *Acacia sundra*.** *Indian For.* 70, 1944 (437).

In *Acacia catechu* the branchlets are brown and the petiole of the leaves, leaflets, calyx and petals are all covered with long, spreading hairs, while in *A. sundra* the branchlets are usually red and the stalk of leaves, leaflets, calyx and petals are smooth, without any covering of hairs. *A. catechu* predominates in north-west India, and *A. sundra* in the west and south of India.

12.26–8. RICKETT, H. W. ***Cornus stolonifera* and *Cornus occidentalis*.** *Brittonia* 5, 1944 (149–59).

The common 'Red Osier' (*Cornus stolonifera* Michx.) of the north-eastern United States is well known and easily recognizable. As one goes westward, however, one encounters an increasingly complex and confusing group of plants obviously related to this species, to which many names have been given. A survey of these, taking account particularly of the characters of the endocarp, size of flowers, and variability of pubescence, leads to the conclusion that, in their attempts to classify these plants mainly by pubescence, previous writers could do little more than rotate them in various combinations as varieties of each other. The present study indicates that the variety of types of pubescence is a result of hybridization and segregation between two archetypes, and the assumption is made that the extremes of pubescence, as of flower size and endocarp characters, represent the original parents, *Cornus occidentalis* and *C. stolonifera*. The fact of hybridization among species of *Cornus* has been generally recognized, but it has not perhaps always been realized that hybrids between species can be fertile and yield a diversity of fertile offspring. The proposed nomenclature is as follows:—*Cornus occidentalis* (T. & G.) Coville; *C. stolonifera* Michx.; *C. stolonifera* f. *baileyi* Rickett, comb. nov.; *C. stolonifera* f. *interior* Rickett, comb. nov.

12.26–8 : 12.14.7 : 12.13. BOCHANTSEVA, Z. P. Materialy po biologii zveteniya i embriologii chernogo saksaula *Haloxylon ammodendron* Bge. **[An investigation into the biology of flowering and the embryology of *Haloxylon ammodendron* Bge.]** *Bot. Zh. SSSR* 29, 1944 (36–47). [Russ.e.] O.B.D.

The buds are initiated at the end of summer but become visible only at the end of autumn. In early March buds situated on reproductive branches start into growth, forming 3 or 4 nodes by the end of March. The lower nodes bear flowers, the upper ones bear leaves. There are also entirely vegetative branches. There is copious flowering between April 6 and 22 near Tashkent, where these observations were made, and much pollen is produced. As the first flowering period ends, vegetative growth predominates over reproductive development until about mid-August, when another flowering period ensues. The article contains a description of detailed microscopic examination of the male and female reproductive organs, and of the embryo.

12.26–8 : 21. COMTE, F. Juglandées (Noyers). **[The Juglandaceae (Walnuts).]** *J. for. suisse* 95, 1944 (226–8). [F.]

The Black Walnut (*Juglans nigra*) and the Butternut (*J. cinerea*) might well be used extensively for planting in European forests. They are extremely hardy, apparently unaffected by late frosts, and immune to fungus attack. *J. nigra* is the more valuable of the two, its wood being the equal of, or superior to, that of the common Walnut (*J. regia*) though the fruit is somewhat inferior. It will grow in close, pure stands, or mixed with indigenous species, whose competition it can endure. Its growth is rapid and sustained. The only disadvantage of this species is a certain lack of vigour in the root system, which makes it unsuitable for planting in an impermeable soil.

12.26–8 (729.1). DWYER, J. D. **The genus *Pseudocopaiva* Britton and Wilson.** *Trop. Woods* No. 80, 1944 (7–10).

The Cuban species *Copaifera hymenaefolia* differs so markedly from other *Copaifera* species that a new genus *Pseudocopaiva* is proposed for it. It is also desirable that the closely related Paraguayan species *C. chodatiana* should be renamed *Pseudocopaiva chodatiana*. The principal botanical differences between the two genera are given.

12.26–8 : 12.11.2. BEKETOVSKI, D. N. K kharakteristike geterogennoy formy *Robinia pseudoacacia* L. var. *monophylla* Kirchn. **[On the character of the heterogeneous form *Robinia pseudoacacia* L. var. *monophylla* Kirchn.]** *Bot. Zh. SSSR* 29, 1944 (29–35). [Russ.e.] O.B.D.

Evidence has been brought forward by Korzhinskii and other investigators, showing that atypical forms of *R. pseudoacacia* L. are wanting in reproductive vigour, and are also in other respects handicapped in the struggle for survival. Although the author has himself confirmed the existence of such characters as failure of seeds to reach maturity, fewness of seeds per pod and poor germination, yet he shows that in the case of *R. pseudoacacia* L. var. *monophylla* Kirchn. these shortcomings are balanced by such characters as an ability for self-pollination, which the typical form lacks; an average number of florets per inflorescence which is about equal to that in the typical form; and a proportion of seed set, as a result of self-pollination, which is larger. It is pointed out, in conclusion, that the emergence of atypical forms, with their unstable complement of inherited characters, constitutes pliable material in the hands of the plant breeder who, taking note of Michurin's and Lysenko's observations, should not overlook the possibilities which such forms offer.

12.26–8 : 23.24 : 24 : 33.0. MIELE, C. Die Akazie (*Robinia pseudoacacia*). Anpflanzung. Pflege und Verwertung des Holzes. Für Waldbesitzer und Holzindustrielle. **[*Robinia pseudoacacia*. Planting, cultivation, and uses of the timber. For forest owners and timber industrialists.]** Reichsnährstands-Verl. G.m.b.H., Berlin, 1941. pp. 12. [G.] Price R.M. 0.50. *Abstr.* in *Holz Roh- u. Werkstoff* 5, 1942 (371–2). P.R.

Robinia pseudoacacia is of more varied use to the forest owner than any other tree species. It displays many good qualities: the wood is very hard, tough, strong, and moisture-resistant. Once planted, however, *Robinia* is very difficult to eradicate on account of its strong tendency to coppice. Establishment is

difficult in areas where rabbits or deer abound. In 20 years *Robinia* reaches a height of 4 to 5 m. and a diameter of 10 to 15 cm. The volume increment is greater than that of almost any other timber species, and the wood can be utilized at almost any stage of development. In stands more than 20 years old, cuttings can be made each year without causing damage; this is particularly important in farm forests. The timber provides pitprops, wood for wheelwrights and carpenters, railway sleepers, fence posts, etc. Crooked wood can be used for fences, and any waste provides fuelwood which burns well even when green. To prevent splitting, *Robinia* should be dried with the bark intact.

12.26–8 : 31.41. HOWARD, A. L. **The Willow tree (*Salix* sp.).** *Nature, Lond.* 154, 1944 (835–7).

Popular historical notes on certain species of Willow, notably the Cricket Bat Willow (*Salix alba coerulea*). In addition to its use for the manufacture of cricket bats, the wood of this species, being immune to white ant attack, is used for the manufacture of artificial limbs for use in the tropics.

12.26–8. BARKLEY, F. A. ***Schinus* L.** *Brittonia* 5, 1944 (160–98).

The present paper is a continuation of the author's studies in the Anacardiaceae and reviews the genus *Schinus*. There seems to be no valid reason for maintaining *Duvaua* and *Schinus* as separate genera, and the two groups are here treated as subgenera with *Schinus pearcei* as a link between them. With the exception of *S. molle* L., which extends south from Mexico, the genus is limited in natural distribution to South America, though it is becoming established in warm temperate regions in both the new and old worlds where various species have been introduced as ornamentals. Some 40 species and varieties are described; new ones include *Schinus marchandii* Barkley, sp. nov.; *S. paraguariensis* (Hassler) Barkley, comb. nov.; *S. johnstonii* Barkley, sp. nov.; *S. cabrerai* Barkley, sp. nov.; *S. polygamus* var. *chilensis* Barkley, var. nov.; *S. polygamus* var. *parviflorus* (March.) Barkley, comb. nov.; *S. fasciculatus* var. *boliviensis* Barkley, var. nov.; *S. engleri* Barkley, sp. nov.; *S. andinus* var. *subtridentatus* (Kuntze) Barkley, comb. nov.; *S. venturi* Barkley, sp. nov.; *S. gracilipes* var. *pilosus* Barkley, var. nov.; *S. montanus* var. *crenuloides* Barkley, var. nov.; *S. molle* var. *rusbyi* Barkley, var. nov.; *S. molle* var. *hassleri* Barkley, var. nov.; *S. weinmannifolius* var. *angustifolius* Barkley, var. nov.; *S. weinmannifolius* var. *dubius* Barkley, var. nov.

12.26–8 (7 : 8). CRONQUIST, A. **Studies in the Simaroubaceae—IV. Resumé of the American genera.** *Brittonia* 5, 1944 (128–47).

The genera of Simaroubaceae are for the most part well marked and sharply delimited. *Simarouba*, *Simaba*, and *Quassia* are closely related, but the other American genera are very distinctive. With the genera so well delimited it is not surprising that the family is loosely knit and poorly marked. It has been confused with, and is in one or another respect similar to, the Rutaceae, Sapindaceae, Zygophyllaceae, Anacardiaceae, and Burseraceae. It is here accepted in the sense of Engler. The American genera, here described, are *Suriana*, *Recchia*, *Picramnia*, *Alvaradoa*, *Castela*, *Holacantha*, *Picrasma*, *Picrolemma*, *Simarouba*, *Simaba*, *Quassia*, and *Ailanthus*.

12.26–8 (72 : 728 : 729). DWYER, J. D. **The taxonomy of the Mexican, Central American, and West Indian species of *Ouratea* (Ochnaceae).** *Lloydia* 7 (2), 1944 (121–45). *Abstr.* in *Trop. Woods* No. 80, 1944 (16–7).

Species of *Ouratea* found in Mexico, Central America and the West Indies range from lianas to tall trees, though as a rule they are small trees or shrubs; *O. insulae* R. may attain a height of 25 m.

It is stated that of the 55 specific names in current use for the North American species of the Ourateae, 26 are valid, one is deserving of varietal rank, three are doubtful because of inadequate description and lack of material, and 25 are invalid. Two new species are described, both from Costa Rica.

12.26–8 (943) : 31.0. **Queensland trees. The Blackbutt.** *Qd. agric. J.* 57, 1943 (351). L.S.

The tree characteristics, wood qualities and uses of *Eucalyptus pilularis* are noted briefly. Availability, response to forest management, and ease of working make it a favourite mill wood of eastern Australia.

12.26–8 (729.6). STEHLE, H. Les Glumiflorées des Antilles françaises. Espèces nouvelles pour la Guadeloupe et pour la Martinique. **[The glumaceous plants of the French Antilles. New species for Guadeloupe and Martinique.]** *Carib. For.* 5, 1944 (181–206). [F.f.span.e.] [Institut et Société Botanique de France.]

12.29. Monocotyledons

12.29 (87 : 86). MCCLURE, F. A. **New Bamboos from Venezuela and Colombia.** *Repr.* from *J. Wash. Acad. Sci.* 32, 1942 (167–83).

A description of seven new Bamboos (6 from Venezuela, 1 from Colombia) in 4 genera, of which one—*Elytrostachys*—is new to science. One transfer is made. The species are *Arthrostylidium ampliflorum*, sp. nov., *A. geminatum*, sp. nov., *A. purpuratum*, sp. nov., *A. venezuelae* (Steud), comb. nov., *Elytrostachys typica*, sp. nov., *E. clavigera*, sp. nov., *Chusquea hispida*, sp. nov., *Neurolepis pittieri*, sp. nov.

13. FOREST ZOOLOGY

13.1. *General Zoology*

13.14 : 13.2 (75.5) : 45.3 : 12.25 : 12.26–8. UNDERHILL, G. W. **Some insect pests of ornamental plants.** *Bull. Va. agric. Exp. Sta.* No. 349, 1943. pp. 38. R.A.E. 32A, 1944 (401–2).

The results are given of studies on the bionomics of six insect pests of ornamental plants made at a nursery near Richmond, Virginia, and of the experiments on which the recommendation for control are based. The insect pests are: *Dichomeris marginella*, F., on certain varieties of *Juniperus* (especially of *J. communis*); *Rhyacionia frustrana*, Comst., on *Pinus taeda*, *P. echinata* and other *Pinus* spp.; *Unaspis* (*Chionaspis*) *euonymi* on *Euonymus* spp.; *Argyresthia thuiella*, Pack., on all cultivated species of *Thuja*; *Psylla buxi* on *Buxus* spp.; and *Phytomyza ilicicola* Lw. (*ilicis*, auct.) on *Ilex opaca*.

13.15 : 13.2 : 13.19. KOSMACHEVSKY, A. S. **Ecology and distribution of some Scarabaeidae species.** *C.R. (Doklady) Acad. Sci. URSS* 40, 1943 (38–40). [Е.] [Kirghiz Agricultural Institute.] L.S.

Investigations under both field and laboratory conditions were carried out by the author in various parts of the U.S.S.R. on the following Scarabaeidae species:

Polyphylla irrorata Gebl., *P. adspersa* Mots., *Melolontha hippocastani* F. (the eastern May-beetle), *M. melolontha* L. (the western May-beetle), and *Amphimallon solstitiale* L. (the June-bug). Special attention was paid to the length of the developmental cycle of each species from the egg stage to sex maturity, and to the effective temperatures during that period. The cycle of a complete generation of beetles was from 3 to 5 years. The author discusses various ecological factors which may have influenced the relative distribution of *Melolontha melolontha* and *M. hippocastani*. He considers that historically the latter is the more recent species; its greater adaptability to unfavourable conditions may account for its wider area of distribution.

13.2. *Special (Systematic) Zoology*

13.2 (41.1–4). KEVAN, D. K. **Scottish beetles taken during 1944, chiefly in the Aviemore district of Inverness-shire.** *Ent. mon. Mag.* 80, 1944 (278).

A record of Scottish beetles taken during 1944, including the following species found on trees: *Acanthocinus aedilis* L. on Scots Fir logs, *Leptura* (*Pachyta*) *sexmaculata* L. in a Fir stump, *Saperda scalaris* L., under Birch bark, *Pogonochaerus fasciculatus* Deg., *Elater nigrinus* Pk., *Pissodes pini* L., *P. notatus* F., *Magdalis phlegmatica* Hbst. and a few other beetles on felled Fir tops, *Henoticus serratus* Gyll. under the bark of an Ash log, and *Laemophloeus ater* Ol. with *Salpingus ater* Gyll. and *Rhinosimus planirostris* F. under the bark of branches of a fallen Ash tree which had formerly been attacked by *Hylesinus fraxini* Panz.

13.2 (42.1–8). KAUFMANN, R. R. U. **Notes on *Rhagium bisfasciatum* (Col., Cerambycidae) and its varieties.** *Ent. mon. Mag.* 80, 1944 (262–3).

The author reports the occurrence of various *Rhagium* varieties found in an old and untouched felling in a mixed planting of Scots Pine and Birch (including a few Sallows and Poplars) on the fringes of Oakmere estate, Cheshire. He lists 7 varieties from Cheshire and elsewhere, including the new variety, *R. bifasciatum* var. *blairi*.

13.2 (410). EMDEN, F. I. VAN. **Larvae of British beetles. V. Elateridae.** *Ent. mon. Mag.* 81, 1945 (13–24).

Includes a 9-page key to the genera of British Elateridae, as well as some brief notes on non-British wireworms.

13.2. (410). KAUFMANN, R. R. U. **British longicorn (Col.) records.** *Ent. mon. Mag.* 80, 1944 (260–1).

Beetles occurring on tree species include *Tetropium gabrieli* Weise, *Clytus arietis* L., *Molorchus minor* L., *Rhagium mordax* Deg., *R. bifasciatum* F., *Stenochorus meridianus* Panz., *Strangalia aurulenta* F., *S. quadrifasciata* L., *Acanthocinus aedilis* L., and *Tetrops praeusta* L.

13.2 (410). KAUFMANN, R. R. U. **Is *Pyrrhidium sanguineum* L. (Col., Cerambydidae) a British insect?** *Ent. mon. Mag.* 80, 1944 (261–2).

There appear to be strong arguments in favour of the supposition that *Pyrrhidium* (= *Callidium*) *sanguineum* L. is a fortuitous importation into Britain and should not occur in lists of native British insects.

13.2 : 13.15. STRETTON, G. B. **Further observations on the life-history of *Byctiscus populi* L. (Col., Curculionidae).** *Ent. mon. Mag.* 80, 1944 (279–83).

The author corrects and enlarges on his previous report [cf. *For. Abstr.* 5 (204)] in the light of additional information obtained by further observations on the habits and life cycle of *Byctiscus populi*. The individual White Poplar bushes most frequented in 1943 were deserted at the beginning of the 1944 season and observations were carried out mainly on a new site and with specimens in captivity.

2. SILVICULTURE

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.2. *Coppice Forest*

22.22 : 60.31. BOREL, W. Résultats obtenus par l'allongement à 40 ans de la revolution d'un taillis. **[Results obtained by lengthening the rotation of a coppice to 40 years.]** *J. for. suisse* 94, 1943 (17–9). [F.]

The rotation of Oak coppice in the commune of Versoix, which is managed for the production of tan bark, has been increased from 25 to 40 years. Coupes cut at an average age of 33 years yielded 175 per cent. as much as those cut at 26 years.

22.22 : 12.26–8 : 12.14.7. ALLARD, H. A. **Second year sprouts of Black Cherry, *Prunus serotina*, fruiting.** *Castanea* 9, 1944 (117).

Shoots sprouting from the 3-ft. stump of a 20-year-old Black Cherry (*Prunus serotina* Ehr.) fruited in their second year.

22.8. *Silvicultural Description of Forms of Stand*

22.83 (41.5) : 23.24.2. CLEAR, T. **The role of mixed woods in Irish silviculture.** *Irish For.* 1, 1944 (41–6).

Notes are given on the results of planting mixtures in experimental plots at Avondale. The following are examples of the more important mixtures, all planted on good sites:—

(1) *Mixtures of light-demander and shade-bearer.* Mixtures of Sessile Oak and Beech, Pedunculate Oak and Beech, and Hornbeam and Oak were all unsatisfactory, as in each case the tolerant species outgrew and suppressed the more valuable intolerant species. It is recommended that intolerant hardwoods such as Oak and Ash should be planted some years in advance of the tolerant species.

(2) *Mixtures of intolerant, or light-demanding hardwoods.* A mixture of Oak and Ash gave unsatisfactory results and illustrates the fact that such a mixture is silviculturally unsound.

(3) *Temporary mixtures.* Larch in mixture with Corsican Pine (*Pinus laricio*) suppressed and killed the Pine before the crop was 30 years old. Other mixtures in this category are Oak and Larch, Oak and Spruce, and Maple and Larch. In all cases the conifers, which were intended to play a temporary rôle, suppressed the other species and formed pure crops in a relatively short time. It appears that these mixtures, which are unsound silviculturally, are also financially undesirable.

(4) *Temporary mixtures to reduce planting costs.* This type of mixture has been adopted with all the expensive species. The results obtained have been

variable. *Abies grandis* and *A. nobilis* planted 8 ft. by 8 ft. and interplanted with *A. pectinata* to give a 4 ft. by 4 ft. spacing throughout, resulted in early and complete elimination of the *A. pectinata*. Better results might have been more cheaply obtained by a 6 ft. by 6 ft. planting of the main crop. Similar results were obtained with a mixture of *Pinus insignis* and European Larch, the latter being suppressed early. Larch as a filler suppressed *Pinus strobus*. Japanese Larch suppressed Norway Spruce in a mixture in which the latter was intended to play the rôle of filler; the Larch, however, was planted close enough for normal stocking, and a good, pure crop resulted.

(5) *Mixtures to protect species against frost*. In 1905 Japanese Larch was planted in mixture with Sitka Spruce in alternate rows at 4 ft. spacing. The Sitka Spruce suffered during the first 5 or 6 years from spring frost and aphids and by 1914 the Japanese Larch was dominating and suppressing the Spruce. In 1917 it was concluded that the Sitka Spruce were past recovery, many of them being little more than bushes. However, as a result of thinning and pruning, the Spruce made a surprising recovery and in the third year after thinning a normal growth of 2 to 3 ft. was being made. The volume of Japanese Larch removed by 1925 was 3,345 cu. ft. The Sitka Spruce had reached a volume of 3,500 cu. ft. by 1938. If any conclusion can be drawn from this record, it is that the Japanese nurse might best have been established pure at 8 ft. by 8 ft. as an advance crop and thinning resorted to when the crop was 12 to 15 years old, when the Sitka Spruce could have been introduced with equally good results.

On the whole, it appears that on good soils little advantage and much waste result from even-aged mixtures, but on poor soils such mixtures are of immense, and in some cases of vital, importance.

22.83.2 : 12.26–8 : 57. WIEDEMANN, E. Der Eichenbestand mit Buchenunterwuchs. [**The Oak stand with Beech understorey.**] *Z. Forst- u. Jagdw.* 74, 1942 (305–36). [G.g.]

Investigations were made in various parts of Germany on the yield of Oak of different ages with an understorey of Beech or, in some cases, Hornbeam. Comparison with the yield tables of Schwappach (1920) for Oak in pure, even-aged stands showed favourable results. The investigations indicated that the open-stand system of management of Oak with an understorey is justified from the point of view of both silviculture and economics.

23. FORMATION OF STANDS

23.1. *Natural Regeneration*

23.1 : 12.25. NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

Natural regeneration of the exotic *Pinus radiata* has been successfully established following logging operations in the Whakarewarewa State Forest. Danger from *Hylastes ater*, which threatened for several years, appears to have receded (pp. 2, 7).

23.2. *Artificial Regeneration*

23.21. Choice of Species

23.21 (43.1–5). NACHTIGALL. Über Bedeutung und Anbau fremdländischer Holzarten. [**On the significance and cultivation of exotic tree species.**] *Thar. forstl. Jb.* 94, 1943 (141–86). [G.g.] [Univ. Göttingen.]

The main part of this article consists of two lists of tree species. The first list contains the names of 88 trees and a few small trees and shrubs subdivided under the following headings: (1) naturalized tree species; (2) commonly planted tree species; (3) less commonly planted tree species; (4) tree species seldom planted; and (5) small trees and shrubs. Brief notes are given of their habitat requirements. The second list is of tree species grown at experiment stations in various parts of Germany from 1881 onwards with indications of their suitability for introduction. In an intermediate section dealing with planting experiments in Göttingen forest district, lists are given of species suited to particular sites, micro-climates and soil types in the Oberweser and Leineberg regions.

23.21 (68.9) : 12.25 21.1–3. NYASALAND. **Annual report of the Forestry Department for the year ended 31st December, 1943.** Govt. Printer, Zomba. [1944.] pp. 12.

Following planting trials in Nyasaland, the suitability of six species of Pine to various sites has been fairly well determined. Of these, three species—*Pinus patula*, *P. longifolia* and *P. caribaea*—are now being used in planting schemes; the last-named species gives good growth on swampy clay soils where all the others will fail (p. 3).

23.21 (931) : 12.25 : 60.32 : 12.26–8 : 56.01. NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

Observations made in plots of exotic conifers planted during 1927–29 at high altitudes (2,200–3,800 ft. above sea-level) under exposed conditions on the central North Island Plateau, showed *Pinus murrayana* and *P. ponderosa* to be the most thrifty species followed by *P. austriaca*, *P. sylvestris*, *P. banksiana*, *P. rigida* and *P. strobus*. Other species, including *P. radiata*, gave poor results. Trees of all species are heavily branched and of poor timber form, but the study gives a good indication of the species most suitable for the extension of upland protection forests (p. 7).

In an experimental interplanting of worked Podocarp forest with exotic hardwoods, two South American Beeches (*Nothofagus procera* and *N. obliqua*) and Red Alder (*Alnus rubra*) showed particularly good height growth and development (p. 7).

23.23. Sowings

23.23.1. *Seed Procurement, Treatment, and Testing*

23.23.11 : 12.26–8. DOWNS, A. A., and MCQUILKIN, W. E. **Seed production of southern Appalachian Oaks.** *J. For.* 42, 1944 (913–20). [Appalachian Forest Exp. Sta., Asheville, N.C.]

Seven years' records of seed production are presented for five species of Oak—Eastern Red Oak (*Quercus borealis maxima*), Black Oak (*Q. velutina*), Scarlet Oak (*Q. coccinea*), White Oak (*Q. alba*), and Chestnut Oak (*Q. montana*)—at two locations in the southern Appalachian region.

Total acorn production per tree increased with tree diameter in Black Oak, and up to about 26 in. d.b.h. in Scarlet and Chestnut Oaks; in Eastern Red Oak and

White Oak production declined in the larger diameters —above 21 and 27 in. d.b.h., respectively.

The average annual production for the 7-year period was 1,213 well-developed acorns per tree, though records of individual trees varied widely. Well-developed acorns when they dropped averaged 46 per cent. sound, 30 per cent. damaged by insects, and 24 per cent. damaged by birds and squirrels. A large proportion of the sound acorns are subsequently destroyed by insects and animals. Regeneration appears to depend mainly on occasional large seed crops.

In a seed-tree cutting, at least 10 trees per acre, 17 in. d.b.h. and larger, or better 20 trees 12–16 in. d.b.h., evenly distributed, should be left to regenerate the area. *From authors' summary.*

23.23.11 : 12.25 : 22.11. JEMISON, G. M., and KORSTIAN, C. F. **Loblolly Pine seed production and dispersal.** *J. For.* 42, 1944 (734–41).

Eight years' records of seed production in a 70-year-old, fully-stocked stand of Loblolly Pine (*Pinus taeda*) in the Duke Forest at Durham, N.C., and distribution to leeward over a 132-ft. cleared strip for 4 years, and over a 264-ft. cleared strip for an additional 4 years, have shown the following:—

(1) Two of the 8 years produced good seed crops, 3 were medium, and 3 were poor.

(2) The greatest catch of seed was in and adjacent to the stand. During the first 4-year period, 39 per cent. as much seed fell on the portion of the clear-cut strip 100 to 132 ft. down wind as under the timber canopy. In the second period, in a portion of the cleared strip 199 to 264 ft. distant, 34 per cent. as much seed was caught as under a complete canopy.

(3) Viability of seed, as determined by cutting tests, varied between 29 and 57 per cent. from year to year.

(4) Highest viability occurred in years of abundant seed production; the lowest proportion of sound seed was in poor seed years.

(5) There was no relation between viability and distance from seed source.

(6) The percentage of sound seed varied with the season of the year. Greatest viability coincided with the peak of seed fall, which occurred in early November.

(7) Warm, dry, windy periods increased release of seed; cool, moist periods retarded it.

(8) One good seed year, in which 100,000 to 300,000 seeds are distributed per acre of cleared land, will be adequate to regenerate the area with 1,000 established seedlings. Four medium, or 10 poor seed years are theoretically the equivalent of one good year.

(9) Alternate strips, 150 to 200 ft. wide, at right angles to the prevailing wind direction, or patches 150 to 200 ft. across, can be safely clear-cut if bordered by well-stocked, seed-producing stands to windward. *From authors' summary.*

23.24. Formation of Stands by Planting

23.24 : 12.25 : 56.03. LANE POOLE, C. E. **Monterey Pine. Space and increment.** *Aust. For.* 8, 1944 (20–30).

The Commonwealth Forestry Bureau has developed the use of very small sample plots, the results from which are based on the growth of a single tree; this method is suitable for studying plantations of exotic Pines which are set out in rows. The unit is a plot of 9 trees, one central and 8 surrounding trees.

The first experiment on these lines was made to measure the response of the central tree when 0 to 8 trees were thinned from around it. It was found (1) that the relative position of the central tree and trees removed made no difference to the effect on the central tree; (2) that increment in basal area increased in a straight line for every tree removed up to 7, when the line turned up sharply, probably owing to the small number of plots available with 8 trees removed; and (3) that the increment per cent. in basal area increased at the constant rate of 1 per cent. No relation between the basal area of the trees removed and the increment of the central tree could be found. Root dissection showed that the roots of the trees were grafted together, which may possibly explain the apparent anomaly that numbers, not sizes, of surrounding trees affect the increment of the central tree significantly.

It was shown that the regression is linear and takes the form

$$y = a + \cdot 01\,(b.a.)\,x$$

where y is increment in basal area, x is the number of trees removed and the parameter a is the start of the line, i.e. the increment when $x = 0$ and none of the surrounding trees are removed, and $b.a.$ is the mean basal area of all central trees in the area.

Possible applications of this formula to thinning are discussed and compared with random thinning.

23.24 (77.1) : 23.21. PATON, R. R. **Forest planting in Ohio.** *Bi-m. Bull. Ohio agric. Exp. Sta.* Vol. 29, 1944 (86–92).

Forest planting stock has been distributed to landowners in Ohio by the State Forest Service since 1904. The total stock distributed during the period 1904–38 was 20,675,178 conifers and 8,241,199 hardwood species. A survey of all plantings in Ohio made with trees from State nurseries, up to and including 1938, was made in 1941. The species which have had the best success are listed and notes given on the conditions, methods of planting, etc., best suited to each species. Many failures were due to leaving trees in the package too long and careless handling. Another common mistake was the use of Pines and Spruces for restocking thin areas in native woods. Such plantings are almost always failures, and hardwoods or Hemlock should be used for this purpose.

23.24 : 12.26–8 (67.6) : 21.11 : 45.3. BRASNETT, N. V. **The growing of Mvule in Uganda.** *E. Afr. Agric. J.* 10, 1944 (83–9).

A description of attempts, made during the past 30 years, to grow Mvule (*Chlorophora excelsa*). No regular research has been done, but certain useful information has been collected. It has been proved that the *Phytolyma* gall is not an insuperable obstacle, that in regular plantings hand tending is very helpful and not expensive, and that, even where such tending is difficult, a fair proportion of Mvule will, in favourable conditions, grow slowly through the stage of susceptibility. Light, high shade is certainly favourable and the best results appear to be obtained from two-year-old nursery plants, 5 to 7 ft. high.

23.24 : 12.29 : 21.12. **Directions for planting and care of hardy Bamboos.** U.S. Bureau of Plant Industry, Washington, D.C. [n.d.] pp. 3.

Directions for the planting and cultivation of the hardy Bamboos. The plants of most species, including

some of the giant Bamboos (50 to 70 ft. high), are evergreen at temperatures down to 0° F., and some of the small and medium-sized species, if protected from northerly winds, withstand about – 3° to – 5° F.

23.24.2. *Methods of Planting*

23.24.2 : 07.7. **Another tree-planting machine.** *Amer. Nurserym.* 80, 1944 (22–3).

A description of a tree-planting machine made by the Champion Sheet Metal Co., Courtland, N.Y. The Simplex model can plant about 1,000 trees per hour at a cost of about $2·30 a thousand; the Duplex is capable of planting 2,000 trees per hour at a cost of $1·50 per thousand including tractor hire. Both models have been used on very varied soils and have handled White Spruce, Cedar, Black Locust, and White, Red, Scotch, Loblolly and Austrian Pines, ranging from 1-year seedlings to 4-year transplants.

23.24.2 : 07.7. **Build cheap tree-planting machine.** *Amer. Nurserym.* 80, 1944 (9–10).

Description of a light, relatively inexpensive planting machine designed by the U.S. Forest Service for use in planting windbreaks and shelterbelts. The unit weighs only 500 lb. and can be readily transported from farm to farm in a light truck. With one man driving the tractor and another planting, from 600 to 1,000 trees can be planted per hour in ploughed land.

23.24.3. *Spacing*

23.24.3 : 12.25. HEYWARD, F. J. **Thoughts dealing with proper spacing for planting Pines.** *Naval Stores Rev.* 52 (45), 1943 (8, 10). [Southern Pulpwood Conservation Association, Atlanta, Ga.]

In the past Slash Pine (*Pinus caribaea*) intended for naval stores production has frequently been planted at wide spacing, sometimes 20 × 20 ft., as it is known that open-grown, bushy-topped trees give maximum gum yields. With the development of the pulpwood and other markets for thinnings of this species the tendency has been to reduce spacing to 6 × 6 ft., 6 × 8 ft. or 8 × 8 ft. This has the advantages that the stand is self-pruned, there is a considerable return from the pulpwood produced in thinnings, and residual trees are mostly tall and straight enough to be used as sawlogs or poles after being worked for naval stores. The one disadvantage is that turpentining has to be postponed several years after thinning until the trees have developed bushy tops and a high potential gum yield.

23.24.3 (77.8) : 12.25. CHAPMAN, A. G. **Classes of Shortleaf Pine nursery stock for planting in the Missouri Ozarks.** *J. For.* 42, 1944 (818–26).

Shortleaf Pine (*Pinus echinata*) is the only Pine occurring naturally on the Ozarks Highlands, and the U.S. Forest Service intends to plant it there on a large scale. Experimental plantings were made in 1937 and 1938 in order to effect comparisons between (1) north and south districts of the area, (2) autumn and spring planting, (3) two kinds of cover (cull Oak and dense mixed Oak), (4) three age classes, 1–0 seedlings, 2–0 seedlings, and 1–1 transplants. The results of the experiment indicate that when survival, height growth, and cost of production are taken into consideration, 1–0 seedlings are the most satisfactory stock for general use, and that spring planting gives better results than autumn planting. Where autumn planting is necessary, and where unusually severe competition from ground cover must be met, 1–1 transplants are desirable.

23.24.4. *Time of Planting*

23.24.4 : 23.27 : 23.21 : 12.25. FISHER, G. M. **Autumn planting of evergreens.** *Amer. Nurserym.* 80, 1944 (9–10).

Notes on the planting of evergreens for ornamental purposes, particularly shade-enduring shrubs to be planted under large trees. The species recommended for this purpose are various Junipers, Yews, Canadian Hemlock, and the dwarf Mugho Pine.

23.26. Plant Rearing. Nursery Practice

23.26 (89). IMIZCOZ, E. C., and CUSSAC, C. M. Descripción de la multiplicación forestal del vivero nacional de Toledo. **[Description of forest-tree propagation at the national nursery of Toledo.]** [*Publ.*] *Minist. Ganad. Agric. Republ. Oriental Uruguay* No. 64, 1943. pp. 19. [Span.] C.G.B.

An account is given of the work of the four main sections of the national nursery at Toledo dealing with: (1) seed collection and preparation, (2) sowing, (3) transplanting, and (4) transport of plants either packed or bare root.

23.26 (47.2–6) : 12.11.23 : 12.14.3. LISIN, S. S. Kornevÿe sistemÿ seyantsev drevesnÿkh i kustarnikovÿkh porod v chernozemnoy zone Srednego Povolzhya. **[The root-systems of tree and shrub species in the black-earth zone of the middle Volga.]** [*Trud.*] *vses. nauchno-issledov. Inst. Agrolesomel.* No. 12, 1940 (4–82). [Russ.russ.]

The method and intensity of treating seedlings in the nursery will vary with the natural characteristics of the species and the ecological and economic conditions of the region. This paper gives the results of investigations carried out in nurseries at Kobÿlkin, Mordov ASSR (forest steppe), Kuibÿshev and Studenets, Kuibÿshev Province (southern part of the Trans-Volga forest steppe) and Gamaleyev, Chkalov Province (steppe). The following are the main conclusions:—

(1) In the comparatively moist climate of the forest steppe, tree and shrub species develop shorter and more branched root systems, whereas longer and relatively less branched root systems are produced in the drier climate of the southern part of the Trans-Volga forest steppe and of the open steppe.

(2) Because the majority of lateral roots and root tips (70 to 80 per cent.) of one-year seedlings of Oak, *Acer negundo* and *Fraxinus pennsylvanica* reach to a depth of as much as 30 cm., seedlings should, as a rule, be dug out to a depth of not less than 25 to 30 cm.

(3) Seedlings of the narrow-leaved Oleaster, *Acer negundo*, Oak, *Fraxinus pennsylvanica*, and Yellow Acacia, which root rapidly and deeply, require only weeding and hoeing. On the other hand, shallow and relatively slow-rooting seedlings of Scots Pine, Siberian Larch, *Betula verrucosa*, Tatarian Maple and White Mulberry require additional treatment, especially in the early period of growth, such as covering the seedbeds, watering, and, for some species, shading.

(4) The following points relate to the practical application of particular methods of treatment investigated by the author.

(*a*) Loosening of the soil is the principal method used; this assists in the accumulation and

conservation of soil moisture. In the dry regions of Trans-Volga, when raising seedlings of *Acer negundo*, Yellow Acacia, *Fraxinus pennsylvanica*, Oak and Wild Apple, it is necessary to hoe the surface of the soil not fewer than five or six times during the growing season in order to secure high-class planting material with compact root systems.

(*b*) Watering is important in obtaining full germination of seedlings in a dry spring. Times of watering must be determined in accordance with the conditions of the plants and of the soil moisture; the minimal limit for moisture in the soil may be taken as being one and a half times the maximal hygroscopicity, and the optimal humidity of the soil, in the absence of sufficient experimental evidence for seedlings of tree species, may be regarded as being equal to 60 per cent. of the full moisture capacity.

For the light clay-loam black-earth soils in Trans-Volga watering should not go beyond a rate of 360 cu. m. per ha.

(*c*) In raising seedlings of broadleaved species with deep main roots, as, for example, *Acer negundo*, Oak, narrow-leaved Oleaster and Yellow Acacia, a straw mulch is useful to maintain moisture in the surface layers of the soil and to ensure a full germination of seedlings. When the seedlings have become hardened, in order to avoid the development of superficial lateral roots, this covering should be removed; the usual cultural operations should then be undertaken.

(*d*) When raising seedlings of Oak, *Acer negundo* and *Fraxinus pennsylvanica* by the double-row strip method with intervals between the strips of 60 cm., it is necessary to increase the distance between the rows to 15 or 18 cm., in order to allow the plants a large enough feeding area and to render it possible to lift the seedlings with the aid of ploughs.

(*e*) The grading of seedlings of tree and shrub species should be based on the degree of development and fibrosity of the root system, the diameter of the root collar and the length of the stem.

Since the division of seedlings of satisfactory quality into two grades—first and second—has not usually resulted in any appreciable difference in the death rate of plants, this practice is not considered to be important. Weak seedlings of grade three should not, as a rule, be used for planting. In exceptional circumstances for certain valuable species a further grading of the undeveloped seedlings of grade three may be permitted and these may then be transplanted in the nursery for a year.

23.26.1 (47.2–6) : 11.41.3. ZEPALOV, S. M. O roste seyantsev i srokakh poliva na agrolesomeliorativnykh pitomnikakh. [**On the growth of seedlings and times of watering in rural afforestation nurseries.**] [*Trud.*] *vses. nauchno-issledov. Inst. Agrolesomel.* No. 12, 1940 (83–107). [Russ.russ.]

A study of the water requirements of seedlings in relation to their growth. Correct watering is of great importance, especially in the southern chernozem and chestnut-earth zones. The species mentioned, intended for steppe afforestation, include *Ulmus effusa* Willd. and *U.* (?) *montana*, *Morus alba* L., *Betula verrucosa* Ehrh., *Pinus sylvestris* L.; and farther south *Fraxinus americana* L., *Caragana arborescens* Lam. and others, especially Rosaceous fruit trees.

In the experiments described:—

(1) The course of growth as indicated by weight of dry organic matter of the aerial portions of the plants proved to be a good basis for determining times of watering.

(2) The course of growth as shown by the dry weight of aerial parts has a characteristic curve which differs in different species, the maxima coinciding with the period of greatest growth and hence with the maximum water requirements.

(3) The distribution of such maxima appeared to be relatively fixed, since over a long growing season in a given physico-geographical region it fluctuated less than 10–15 days with different grades of watering. This phenomenon is believed to be connected with fixed phases of growth in seedlings.

(4) Two kinds of watering may be distinguished on this basis: (i) watering during the germination period to encourage the development of the initial shoot; and (ii) "productive" watering which determines the size of the seedlings.

(5) The criterion for applying the first type is soil moisture, which must not drop to the level of the wilting coefficient. As a rule the amount of watering required is small.

(6) In the second case considerable watering is needed, as the object is to secure optimum soil moisture to a depth of 20–30 cm.

(7) The seedlings investigated may be divided according to length of growing season into 3 groups: (i) Rapidly maturing—2-year-old seedlings of *Acer tataricum*. (ii) With medium growing season—1-year-seedlings of *Acer platanoides* L., *Fraxinus americana* L., *Ulmus effusa* and *U.* (?) *montana*. (iii) Late-maturing (up to the second half of Oct.)—*Acer negundo* L., *Pinus sylvestris* and *Ulmus effusa* (when heavily watered). With this group cautious watering should be applied, as heavy watering may prolong their growth period.

23.26.3 : 12.25 : 23.27. **Transplanting and care of evergreens.** U.S.D.A. Bureau of Plant Industry [Washington, D.C.] [1943.] pp. 3.

Instructions for transplanting, tending and pruning evergreen trees and shrubs in the United States.

23.27. Arboriculture

23.27 : 44.3. **Tree wound dressings.** *Amer. Nurserym.* 80, 1944 (28–9).

Canker-stain of London Plane caused by *Endoconidiophora* sp. is spread rapidly from tree to tree by the use of contaminated dressings. This can be avoided by the addition of 0·2 per cent. phenyl mercury nitrate to wound dressings of the gilsonite varnish type. It is not recommended that phenyl mercury nitrate should be used in paints based on petroleum residue asphalt or those carrying Pine oils and tars, as experiments indicate that these combinations may be injurious to the cambium of the London Plane tree.

Successful experiments have been made at the Allegheny Forest Experiment Station in the use of lanolin and lanolin mixtures of rosin and Pine gum as wound dressings. The most successful mixtures were:

) lanolin 100, rosin 20, crude gum 20; (2) lanolin 00, rosin 30, crude gum 20, beeswax 5.

Blends of lanolin and asphaltum also promise well. hese dressings are mostly plastic at ordinary tempera- ures, and should be applied with the fingers. They andle best at temperatures between 60° and 80° F. ood work cannot be done in temperatures lower than 0° or 50° F. Wounds resulting from accidents should, f course, be treated as soon as possible, but tests show at the best healing occurs in wounds made during the pring months, roughly from February to May, and is is, therefore, the best season for doing pruning or avity repair work when wounds are made deliberately. ome of the better dressings have maintained a good eal for over a year on small wounds (3 × 1·5 in.).

23.3. *Afforestation*

3.3 (494) : 23.21. SCHMUZIGER, H. Aufforstungen in öheren Lagen. **[Afforestation at higher elevations.]** *chweiz. Z. Forstw.* 94, 1943 (357–60). [G.]

An account is given of some of the difficulties ex- erienced in the afforestation of an area 1,500–1,780 m. bove sea-level in the Canton of St. Gallen. A project or the afforestation and drainage of this area was first onsidered in 1895, but it was not until 1911 that the ctual work of planting was begun. The success of he scheme was threatened by a combination of dverse factors, and when the author saw the stands in 924 their condition was far from satisfactory. There as an obvious need for the introduction of plant material f suitable provenance, and Green Alder and other ardwoods (Mountain Ash, Sycamore, Willow) were ntroduced with satisfactory results. Green Alder, in articular, has shown great promise, and a forest cover as been obtained in all but a few areas.

Stress is laid on the necessity for adequate drainage success is to be achieved in the afforestation of areas f this type. More than half the cost of the present cheme was spent on drainage.

4.31. CROMIE, G. A. **Forest improvement by girdling.** . *For.* 42, 1944 (887–9).

This article discusses the value of girdling in stand- nprovement operations and gives the results of some ost and time studies of girdling as compared with and improvement by means of thinnings. These udies were made in Connecticut.

23.4. *Formation of Forest by Natural Succession*

3.4 (76.9) : 12.26–8. MCINTEER, B. B. **Revegetation f the abandoned fields of Mammoth Cave National ark.** *Amer. Midl. Nat.* 31, 1944 (501–4).

An account of vegetation recorded on abandoned arm land of poor quality in Kentucky which had not een cultivated for seven or more years.

23.5. *Underplanting*

3.52 : 23.21 : 12.26–8. TELLES, A. de Q. O 'cheiro do nato' (sombreamento do cafeeiro). **[Shading the offee tree.]** *Bol. Superint. Serv. Café* 19 (203), 1944 1182–93); (204), (125–40). [Port.] A.P.B.

There is presented an exposition of the advantages of hading coffee plantations with trees, of the species used, nd of planting technique. Trees of the family of the eguminosae are preferable to any others on account f their nitrogen-fixing capacity, which enriches the soil and reduces competition with the coffee tree. A large number of trees including several spp. of *Inga*, *Erythrina*, *Albizzia* and others are suggested. G. M. R.

23.6. *Care of Regeneration in the Initial Stage of Establishment*

23.6 : 12.25 : 56.01. AUSTRALIA. **Annual report of the Commonwealth Forestry Bureau for year 1943.** Commonwealth Govt. Printer, Canberra. 1944. pp. 12.

The cultivation of plantations of Monterey Pine (*Pinus radiata*) over a period of five years has resulted in average increase in height growth of 5·27 ft. for the period (about 1 ft. per year) in comparison with the uncultivated controls (p. 4).

24. TENDING OF STANDS AND TREES

24.2. *Thinnings*

24.2 (54.2). WARREN, W. D. M. **Thinnings in the Singhbhum forests.** *Indian For.* 70, 1944 (371–5).

Thinnings were begun in 1936 in these 800 sq. miles of forest, both in the young ten-year-old crops (periodic blocks I and VI), and in the older uneven-aged selection forests of the other periodic blocks (II–V). In the young crops, thinnings are mechanical with the aid of a thinning stick, the aim being to thin the crops to an average spacing, the multiple of which will give the ideal ultimate spacing of the crop at the final felling. Uneven-aged crops are given 'C' grade thinnings with a formula showing the relationship between diameter of stems and their spacing (1 : 18), as guide. 'C' grade thinnings are preferred to crown thinnings as being simple to execute and to inspect. Fire hazard and measures of protection are discussed. *From author's summary.*

24.3. *Opening of the Canopy. Release and Improvement Fellings*

24.31 : 07.7. FISHER, G. M. **Methods of killing weed trees.** *Amer. Nurserym.* 80, 1944 (11–12).

Instructions for poisoning unwanted trees by sodium-arsenite treatment, which has proved the most generally satisfactory poison for this purpose.

24.4. *Shelterbelts. Windbreaks*

24.4 (485). GEETE, E. Läplanteringar. **[Shelterbelts.]** *Skogsägaren* 20, 1944 (211–2, 215–8). [Sw.]

In Denmark the Society for the Cultivation of Heath-land has been responsible for the planting of shelter-belts on an extensive scale to protect agricultural land. During the period 1938 to March 1944, some 30 million trees have been planted for this purpose.

The work done in Denmark indicates that best results are obtained if the belts are planted more or less parallel and some distance apart, the force of the wind being successively weakened by this arrangement.

In Sweden the planting of shelterbelts is now under investigation by a commission presided over by the Minister of Agriculture. No decision has yet been reached as to the species to be selected, but it is probable that Hawthorn, Crabapple and Mountain Ash will be included.

24.4 (66.9) : 23.21 : 12.26–8. BOND, W. E. T. **Hedge plants in Northern Nigeria.** *Trop. Agric.* 21, 1944 (228–30).

Hedge plants used in Northern Nigeria may be divided roughly into two categories:

(1) Shrubs or short plants which are planted closely together with the object of forming an impenetrable hedge.
(2) Live stakes which are planted in rows, usually not more than a yard apart, and to which mats, stalks of corn or wire can be tied to form a fence. On Government farms these are used to support wire-netting or wire, to form a stock- and game-proof fence.

Details of habit, growth, etc. are given for the principal species used. An investigation of two species used as live stakes, *Newbouldia laevis* and *Azadirachta indica*, is reported, and the conclusion reached that neither of these species should be planted round fields or paddocks, as their roots grow from a few inches to a foot below the surface and spread over a large area, causing patchiness in crops and grasses.

24.4 : 12.29. **Artificial culture of running Bamboos for hedge use.** U.S. Bureau of Plant Industry, Washington, D.C. [n.d.] pp. 4.

Directions for artificial methods of growing Bamboo hedges. Though the hardy running Bamboos are not naturally suited for hedge use, it has been found possible by special methods of planting to develop a hedge which will retain a fairly satisfactory form for several years.

24.5. *Pruning*

24.51. Cox, H. A. **Pruning forest trees.** *Wood* 10, 1945 (11–3).

This article emphasizes the need for planned research into method of pruning in British plantations. The aims of pruning are outlined and indications are given of the species to prune, the age at which to begin pruning and the extent to which it should be done.

24.51 : 12.25. AUSTRALIA. **Annual report of the Commonwealth Forestry Bureau for year 1943.** Commonwealth Govt. Printer, Canberra. 1944. pp. 12.

Experiments have shown that Western Yellow Pine (*Pinus ponderosa*) can be heavily pruned without decreasing diameter growth. Trees 7 years old are being pruned to leave 4, 5 and 6 whorls of branches per tree (p. 5).

3. FOREST UTILIZATION. FOREST TECHNOLOGY

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

31 (94). AUSTRALIA. **Standard method of test for timber for aircraft construction.** *Australian Standard* No. (E)CD. 800–1944. A.G.S.

The usual British methods are laid down on standard except—

(1) The moisture content sample must be taken $b + h$ in. from the plank end, where $b \times h$ sq. in. is the cross sectional area.
(2) In the density test, accuracy limits of $\pm$ 1 per cent. on weight and $\pm$ 3 per cent. on volume are specified.
(3) Two Izod samples must be taken from diagonally opposite corners of one end of planks, 20 ft. long or less, and an extra two from the opposite corners of the other diagonal on the other end, if the plank is more than 20 ft. long.
(4) An alternative Izod specimen $\frac{7}{8}$ in. $\times$ $\frac{11}{16}$ in. is permitted, the $\frac{7}{8}$ in. width, and the $\frac{1}{8}$ in. depth from the $\frac{1}{8}$ in. diameter hole to the back being maintained. (Note that in British specifications the Izod test is no longer mandatory.)
(5) Compression specimens must be cut from Izod specimens or end matched to them.
(6) The procedure for detecting starch and determining the boric acid content is defined.

31 : 33.15. FRANKLIN, G. L. **Preparation of thin sections of synthetic resins and wood-resin composites, and a new macerating method for wood.** *Nature, Lond.* 155, 1945 (51).

Various softening methods have been used in preparing sections of hard materials for microscopic examination, but none of these has been found effective for so-called 'improved wood' made up of wood veneers impregnated with phenol-formaldehyde or other resin and compressed and bonded at a high temperature. It has now been found that a mixture of 1 part by volume of glacial acetic acid with 2 parts by volume of hydrogen peroxide (20 volumes) at 60° C. and atmospheric pressure has a softening action on fully cured phenol-formaldehyde and ureaformaldehyde resins and on wood-resin composites. After being treated in this way for periods of 24–48 hours, solid blocks of resin and of various types of 'improved wood', up to $\frac{1}{2}$ in. cube, have been sectioned without difficulty in a Reichert sledge-type wood microtome.

A modification of this treatment, using equal parts by volume of glacial acetic acid and hydrogen peroxide at 60° C. for 48 hours, has the effect of decomposing or disintegrating urea-formaldehyde resin. Phenol-formaldehyde resins are softened to the extent that 'improved wood' incorporating such resins is broken down and the wood itself is macerated.

The effect of varying the proportions of the two reagents and the temperature and pressure during the reaction is being investigated further.

31 (51) : 12.26–8. **The Forest Products Laboratory, Kaiting, China. (An outline of its plan and works.)** 1943. pp. 3.

This institution was set up in 1939 at Paipei, Chungking, but after being bombed in 1940, was removed to Kaiting, which has the advantage of being nearer the principal forests. The following work has been carried out, or is in progress.

(1) Expeditions were made in 1940 to Sapin, in 1941 to Lifan, in 1942 to Kweichow, Kwangsi and Hunan, to collect samples and field information. A study was made of forests and lumber markets along Ching-yi River.
(2) A preliminary manual of Chinese commercial timbers has been published, and studies in wood anatomy are being pursued. More than 600 slides of Chinese timbers have been prepared.
(3) Intensive physico-mechanical tests have been carried out on the properties of Chinese Oak (*Quercus acutissima*). More than 2,000 tests

have been made in the green condition of *Schima crenata* and *Castanopsis platyacantha*.

(4) Exposure tests on the durability of some Chinese timbers were begun in 1941.

Altogether more than 50 technical papers have been published.

31 (47.1) : 33.15 : 33.39 : 38.1. LEVON, M. Die holztechnische Forschung in Finnland. [Technical research on wood in Finland.] *Abstr.* in *Holztechnik* 22, 1942 (283). [G.] P.R.

Research on subjects relating to the timber industry and to the pulp and paper industry of Finland is carried out either at certain State-maintained institutes or at special centres set up by the industries concerned. One of the most important subjects of enquiry during the war period has been the use of wood, and particularly of Birch plywood, in aeroplane manufacture. In the sphere of wood chemistry attention has been directed towards the question of wood saccharification, particularly by the so-called Ant-Wuorinen method. The production of prefabricated wooden houses has been the most noteworthy war-time development in the building industry.

31.0. *General Information on Woods*

31.0 : 31.8 : 31.2 : 33.0. AVERY-FOWLER, J. A. **Conferning timber.** *Ill. Carp. Build.* 133, 1944 (1216, 1270, 1294). P.R.

Brief notes are given on a number of defects that occur in timber, and on the properties and uses of the more important hardwood and softwood timbers.

31.0 : 12.26–8 (729.3). SCHIFFINO, J. Riqueza forestal dominicana. **[The forest wealth of the Dominican Republic.]** *Rev. Agric., Rep. Dominicana* 35, 153, 1944 (40–4). [Span.] *Abstr.* in *Trop. Woods* No. 80, 1944 (16).

Contains accounts of 3 trees, namely, Cedro (*Cedrela odorata*), Caya Amarilla (*Sideroxylon foetidissimum*), and Caya Colorada (*Dipholis salicifolia*) which are useful for their timber in the Dominican Republic.

31.0 : 12.26–8 (728 : 8) : 12.19 : 33.36.3. COX, W. T. **Some facts about Balsa.** *J. For.* 42, 1944 (714–5).

Balsa (*Ochroma* sp.) is a small to medium-sized, quick-growing tree, commonly logged when 6 to 7 years old, 12 to 18 in. in diameter, and 60 to 80 ft. high. There are no real plantations of this species in Central or South America and it is usually found as single trees or in small patches in the natural forest.

Most trees contain sweeps and curves, and in general logs should be cut in lengths shorter than 16 ft. to avoid loss in sawing. Freshly felled logs are quite buoyant although they contain a much greater weight of water than of wood.

Balsa lumber is easy to dry even in the wet season, and air-drying under thatched roofs for 1 to 3 weeks usually reduces moisture content to about 15 per cent. As the lumber usually absorbs considerable moisture during transport by ship, it is necessary that it be kiln-dried, irrespective of whether this was done previous to shipment, before the lumber is used in any factory.

The weight of Balsa wood ranges from 5½ to 26 lb. per cu. ft. of dry lumber, and it is suggested that the present grades for Balsa should be altered so that wood over 14 lb. in weight would not be included at least in Grades AA, A, and B.

31.0 : 12.26–8 : 12.19 : 33.0. **The properties of Australian timbers: Cheesewood (*Sarcocephalus cordatus* Miq.).** *Mon. News Lett. Div. For. Prod. Aust.* No. 131, 1944 (5).

31.0 : 12.26–8 : 12.19 : 33.0. **The properties of Australian timbers: Yellow Boxwood (*Sideroxylon pohlmanianum* Benth. and Hook.).** *Mon. News Lett. Div. For. Prod. Aust.* No. 133, 1944 (5).

31.0 : 12.26–8 : 12.19 : 33.0. **The properties of Australian timbers: Kanuka (*Tristania laurina* R. Br.).** *Mon. News Lett. Div. For. Prod. Aust.* No. 134, 1944 (7).

31.0 : 12.26–8 : 12.19 : 33.0. **The properties of Australian timbers: Silver Sycamore (*Cryptocarya glaucescens* R. Br.).** *Mon. News Lett. Div. For. Prod. Aust.* No. 135, 1944 (6).

31.0 : 12.26–8 : 12.19 : 33.0. **The properties of Australian timbers: Rose Maple (*Cryptocarya erythroxylon*).** *Mon. News Lett. Div. For. Prod. Aust.* No. 132, 1944 (7).

31.1. *Structure. Anatomy. Identification*

31.1 : 12.26–8. **Project 9. Study and description of the structure and general properties of timber. *Progress report* 4—Part 3. A lens key to hardwood timbers.** Forest Products Research Laboratory, Princes Risborough, Bucks. 1940. pp. 50.

The features used for identifying hardwood timbers by hand lens are listed and illustrated with explanations, and a wide range of timbers are tabulated with indications as to the presence and degree of each of these features.

31.1. EVERINGHAM, H. **Examples in timber sections.** *Pract. Engng.* 10 (241), 1944 (170–1). A.G.S.

Micro-photographs (× 100) of section of four timbers are given and briefly discussed.

31.1. RECORD, S. J. **Keys to American woods** (continued). *Trop. Woods* No. 80, 1944 (10–5).

The fifteenth and sixteenth keys of the series are for (15) woods having fibres with conspicuous bordered pits, and (16) woods with oil (or similar) cells.

31.1 : 12.26–8 (213). RECORD, S. J. **Notes on tropical timbers.** *Trop. Woods* No. 80, 1944 (1–6).

Brief anatomical notes are given on the following timbers:—*Aspidosperma multiflorum, Laplacea brenesii, Albizzia fulva, Cedrela, Swietenia macrophylla, Pseudocopaiva hymenaefolia.*

31.2. *Physical Properties*

31.2 : 12.25–8 (54) : 33.0. LIMAYE, V. D. **Suitability and selection of timbers for different uses. Parts I and II.** *Indian For. Rec.* (*n.s.*) *Utilization* 3 (5), 1944. pp. 34 + 2 + dgms. + x. [Forest Research Institute, Dehra Dun.]

This bulletin provides comparable data on the properties of a large number of Indian-grown and a few Indian-imported timbers, as a guide in selecting those most suitable for different uses. Index figures and stick graphs are given to show the value of each timber in relation to Teak with reference to weight, strength as a beam, suitability as a post, shock-resisting ability, retention of shape, shear and hardness. Information is also given on those qualities that must be considered in selecting a timber for each of a number of uses.

31.2 : 12.26–8 : 33.0. CALLAHAM, J. R. **Lignum-vitae wood for processing applications.** *Chem. metall. Engng.* 51 (5), 1944 (129–31). L.S.

A brief account of the properties and uses of Lignum-vitae (heartwood of *Guaiacum officinale* L.). Being self-lubricating and non-contaminating under selected conditions, this wood is often ideal for use in the food, pharmaceutical, textile and other processing fields.

31.2 : 12.26–8. FOSTER, E. L. P. **Lignum vitae. (With some remarks regarding Red Kutch.)** *Indian For.* 70, 1944 (370–1).

An account of the physical properties of Lignum-vitae, with a suggestion that Red Kutch (*Acacia catechu* var. *sundra*) might provide a good substitute. The tests so far made on specific gravity, weight per cu. ft., maximum crushing strength and hardness show that the Indian wood is little inferior to that of *Guaiacum officinale*. The resin content (not yet estimated exactly) is also very high.

31.2–3 : 38.1 : 33.15. MARKWARDT, L. J. **Wood as an engineering material.** *Repr.* from *Proc. Amer. Soc. Test. Mat.* 43, 1943. pp. 58.

This paper gives a comprehensive survey of information on wood, dealing with its formation, structure and composition, characteristics, uses, both direct (e.g. structural) and following modification of its properties (e.g. plywood and plastics), and its destruction by various agencies and their control.

31.22. Relation to Water, Air, Gases

31.22.1 : 12.26–8 (94). ROBERTS, H. D. **The moisture content distribution in wood used as a partition between water and air.** *Repr.* from *J. Coun. Sci. Industr. Res. Aust.* 17, 1944 (133–8).

An account of an experiment designed to determine the comparative moisture absorption and the final moisture equilibrium condition of certain Australian timbers when used in a form involving the intimate contact of one face with water and the other face with air. The five Australian species Karri (*Eucalyptus diversicolor*), Celery-top Pine (*Phyllocladus rhomboidalis*), Blackwood (*Acacia melanoxylon*), Mountain Ash (*Eucalyptus* sp.), and Queensland Maple (*Flindersia brayleyana*), and the exotic Douglas Fir (*Pseudotsuga taxifolia*) were used in the form of planks 2 in. thick.

The results indicate that when one face of a 2-in. partition is kept continuously wet and the other face continuously dry, a very high moisture gradient exists across the thickness of the partition, once equilibrium is established. The average moisture content of the $\frac{1}{16}$ in. of wood nearest the wetted face approached the average green moisture content of the species, whereas that of the $\frac{1}{8}$ in. nearest the dry face (in contact with the air) reached approximately 14 per cent. At a distance of from $\frac{1}{2}$ to $\frac{3}{4}$ in. in from the wetted face, the moisture content tended to reach equilibrium at approximately the fibre saturation point for the species.

31.22.1 : 31.23. KOLLMANN, F. **Testing the moisture content and the 'raw weight' of wood.** *Anz. Maschinenw.* 65 (19), Suppl. 1–3, No. 24, 1943 (3–4). [G.] *Chem. Zbl.* II, 1943 (1163). Chem. Abstr. 38 (6065). P.R.

Moisture is determined by drying to a constant weight at 103° or by extraction with a solvent not miscible with water, as xylene, toluene or $CHCl_2CHCl_2$. Moisture can be determined approximately by hygroscopic methods. It can also be determined by the aid of electrical instruments, the operation of which depends upon the measurement of the ohmic resistance. Various methods for the determination of the 'raw weight' are reported. The relation between this quantity and the moisture content is discussed and a mathematical derivation of the relation is given.

31.27. Mechanical Strength

31.27 : 12.25 : 51.8. YLINEN, A. Dehnungsmessungen in der Umgebung von Ästen beim Kiefernholz. [**Tension measurements in the region of knots in Pine wood.**] *Holz Roh- u. Werkstoff* 5, 1942 (337–8). [G.g.] P.R.

The strength properties of wood are greatly reduced by knots. The influence of knots is hard to determine theoretically because the course of tension in their vicinity is very complicated and the nature of knot wood is quite different from that of normal wood. In order to obtain a rough picture of the breaking process in the presence of a knot, the author has carried out tension measurements in Pine wood at the State aeroplane works in Finland.

31.27 : 31.25 : 07.7. HEIDEN, H. Beitrag zur zerstörungsfreien Holzprüfung. [**Contribution to non-destructive wood testing.**] *Holz Roh- u. Werkstoff* 5, 1942 (185–93). [G.g.] P.R.

The author describes the apparatus and procedure by which the hardness and compression strength of wood can be determined without destroying the test blocks. The apparatus consists of a portable stamping machine and measuring watch. The relation between the compression strength of a timber and the depth of the imprint is illustrated by reference to tests with Spruce, Fir, Pine, Oak and Beech. Data are also given on the relation between compression strength and certain variable factors such as raw weight, percentage of late wood, and ring width.

31.27. FLATSCHER, H. Was muss man von den technischen Eigenschaften des Holzes wissen? [**What must one know about the technical properties of wood?**] *Internat. Holzmarkt* 34/35, 1944 (29–32). [G.] M.E.W.

A discussion on elasticity and the various strength properties of wood.

31.27 : 12.25 : 31.23. NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

Preliminary tests of *Pinus radiata* timber show that, except for very rapidly grown and young wood, its air-dry strength in both bending and compression is relatively high in relation to its density (p. 20). Average figures for the specific gravity of three trees of this species were: butt, 0·432; mid-height, 0·403; and merchantable top, 0·399 (p. 21).

31.27 : 12.26–8. NORTHERN RHODESIA. **Department of Agriculture. Annual report for the year of 1943.** The Director of Agriculture, Mazabuka. 1944. pp. 11.

Tests have shown that *Brachystegia* and *Isoberlinia* timbers have high strength values—about double those of imported Douglas Fir (p. 9).

31.3. *Chemical Properties*

31.3 : 12.25. SCHMIDT-NIELSEN, S., and HÖYE, J. **Further observations on the resistance of Pine lignin.** *K. norske vidensk. Selsk. Forh.* 15, 1942 (123–6). *Chem. Zbl.* II, 1943 (2255). Chem. Abstr. 38 (6553). P.R.

Various samples of ligninthioglycolic acid obtained by the method of Holmberg were analysed. The samples were obtained (1) from various Pine woods which had stood more than 100 years in sea and peat water and had become strongly corroded (i.e. their cellulose had been dissolved out while they had become enriched in lignin) and (2) from various specimens of resinous Pine. Comparison of the analytical results with values obtained for ligninthioglycolic acid from fresh Pine wood revealed no great differences, although the samples of the two classes above showed somewhat lower values for methoxyl, and those of the second classes showed somewhat higher values for S.

31.3 : 12.25. SCHMIDT-NIELSEN, S., and HÖYE, J. **The determination of lignin according to Holmberg.** *K. norske vidensk. Selsk. Forh.* 15, 1942 (99–102). *Chem. Zbl.* II, 1943 (2255). Chem. Abstr. 38 (6553). P.R.

The lignin content of various specimens of fresh, aged and corroded Pine wood and of resinous Pine was determined as ligninthioglycolic acid, according to the method of Holmberg, and the composition was determined by analysis.

31.3. STAUDINGER, M. Chemische Anatomie des Holzes. **[Chemical anatomy of wood.]** *Holz Roh- u. Werkstoff* 5, 1942 (193–200). [G.g.] [Univ. Freiburg i. Br.] P.R.

This paper deals with a new process for separating cellulose and lignin in wood sections while maintaining the tissue structure. The distribution of the various components of the wood of coniferous and broad-leaved species is illustrated by means of photographs showing the microscopic structure of the lignin and cellulose sections. The species studied were *Picea abies, Larix decidua, Betula alba, Quercus pedunculata, Fagus sylvatica, Acer pseudoplatanus* and *Populus nigra*. Investigations were also made on Spruce infected with *Fomes annosus*.

31.3 : 12.25. SCHMIDT-NIELSEN, S., and REFSNES, E. Einige Analysen von Kienholz. **[Some analyses of resinous wood.]** *K. norske vidensk. Selsk. Forh.* 15, 1942 (79–82). Chem. Zbl. II, 1943 (2122). D.S.I.R.

Analyses of resinous wood of *Pinus sylvestris*. Investigations were made on three samples from stumps, two from branches and two from butt logs. The raw fat extracted varied from 6·5 per cent. (butt log) to 35·4 per cent. (stump). If the percentage of the other components is based on fat-free wood, the pentosan, cellulose, ligninthioglycolic acid and acid lignin contents show only insignificant variation. The resinous wood differs only slightly from fresh Pine wood except for α-cellulose content which increases from 27·7 and 29·5 per cent. in fresh Pine wood to 39·3 per cent. in resinous wood. The raw fat of resinous wood is for the most part extractable with ether.

31.3. LÜDEKE, M. Über die Pektinstoffe des Holzes. **[On the pectin substances of wood.]** *Holz Roh- u. Werkstoff* 5, 1942 (338–44). [G.] P.R.

Pectin is present in wood only in small quantities, so that its presence is sometimes overlooked. It is soluble only with difficulty and cannot easily be separated from the other constituents of the wood, at least in a pure form. A process for the separation of pectin is described. Data are given on the relationship between the pectins and other components of the cell wall, and reference is made to other acid substances present in the wood.

31.3 : 12.25. CUNDY, R. F. **The chemical analysis of Black Spruce wood.** *Paper Ind.* 26, 1944 (170). [Institute of Paper Chemistry.] L.S.

A sample was prepared from a single stick of Black Spruce (*Picea mariana*) pulpwood and analysed with the following results:—

	Per cent.
Alcohol-benzene solubility	2·2
Hot water solubility	2·1
Ash	0·29
Cross and Bevan cellulose	57·2
Alphacellulose on Cross and Bevan cellulose	45·8
Lignin	27·3
Pentosans	12·5
Polyuronides (as CO_2)	0·86
Mannan	8·5
Methoxyl	4·65
Acetyl	1·16

The percentage was calculated to oven-dry, unextracted basis. All determinations except the first three were made on extractive-free wood. Notes are given on methods used.

31.3 : 12.14.8 : 12.25. LEWIS, H. F., BRAUNS, F. E., BUCHANAN, M. A., and KURTH, E. F. **Chemical composition of Redwood bark.** *Industr. Engng. Chem.* (*Industr. Ed.*) 36, 1944 (759–64). [Institute of Paper Chemistry, Appelton, Wis.] P.R.

Redwood bark is separated commercially into two fractions, 'bark fibre' and 'bark dust'. The former is used for insulation and is blended with various fibres for textile and related purposes. Bark fibre is inherently a cellulose fibre. After delignification it swells with cuprammonium solution as does a wood fibre. In its raw state the cellulose appears to be combined with lignin by a linkage which is resistant to splitting by caustic soda or by phenol and acid. Part of the lignin appears to be closely related structurally to Sprucewood lignin. One other compound appears to be associated with the fibre in its raw state—a low-methoxyl phenolic acid; a second may be present, which closely resembles lignin but contains a definite percentage of carboxyl groups. The first of these is readily soluble in alkali; the second is somewhat more difficultly soluble. Small amounts of catechol-type tannins and phlobaphenes and a carbohydrate gum are also present in the fibre.

Bark dust consists of a heterogeneous mixture of broken fibres and parenchyma cells, together with a large amount of the low-methoxyl phenolic acid found in the fibre. This substance probably makes up 70–80 per cent. of the bark dust. The carbohydrate gum present in the fibre is also present in the dust to the extent of 8–9 per cent. It is soluble in hot water and precipitated with alcohol, and at least half of it is peptic acid. Small amounts of catechol-type tannins and phlobaphenes are likewise present in the dust. *Authors' summary.*

31.3 : 12.25. BRAUNS, F. E., and LEWIS, H. F. **The nature of the lignin in Redwood bark.** *Paper Tr. J.* 119 (22), 1944 (34–8). P.R.

31.3 : 12.25. BUCHANAN, M. A., LEWIS, H. F., and KURTH, E. F. **Chemical nature of Redwood tannin and phlobaphene.** *Industr. Engng. Chem.* (*Industr. Ed.*) 36, 1944 (907–10). [Institute of Paper Chemistry, Appleton, Wis.] P.R.

Tannin and phlobaphene have been isolated from Redwood (*Sequoia sempervirens*); both can be acetylated and methylated. The purified tannin contains methoxyl 2·8, carbon 63·6, hydrogen 5·6, phenolic groups 15·4, and total hydroxyl groups 20·3 per cent. The phlobaphene contains methoxyl 6·9, carbon 66·8, hydrogen 5·9, phenolic groups 10·1, and total hydroxyl groups 13·7 per cent.

31.3 : 12.25–8 (54) : 33.32. AHMAD, N., and KARNIK, M. G. **A technical survey of cellulose-bearing materials of India.** *J. sci. industr. Res., India* 2, 1944 (275–90). [Indian Central Cotton Committee Technological Laboratory, Bombay.] I.H.

Laboratory tests were made to determine the α-cellulose content of various cellulose-bearing materials of India and to assess their potential value in the manufacture of rayon and paper. The 37 samples investigated came from eleven groups; the timber group contained Fir, Spruce, Salai (*Boswellia serrata*), Karai (*Sterculia urens*) and sawdust. These were pulped by four processes: (1) The soda, (2) the sulphate, (3) the sulphite, and (4) one using sodium sulphite alone. The results in terms of per cent. α-cellulose, per cent. ash, whiteness, and various other properties are given in tabular form for all the materials and processes tested. Fir and Spruce yielded a high percentage of cellulose, and the pulps obtained from them consisted of long fibres which bleached well. It seems that these two species may be profitably exploited for the rayon industry. Salai and Karai gave less satisfactory results owing to their short fibres and low α-cellulose content.

31.4. *Durability. Decomposition*

31.41. Natural Durability

31.41 : 12.26–8 : 31.3. SCHEFFER, T. C., LACHMUND, H. G., and HOPP, H. **Relation between hot-water extractives and decay resistance of Black Locust wood.** *J. agric. Res.* 68, 1944 (415–26). O.R.E.

Earlier tests have indicated that there are significant differences in wood durability between varieties of Black Locust (*Robinia pseudoacacia*). In order to select desirable strains for large-scale planting it would be necessary to develop a rapid method for testing the wood durability of the many varieties under consideration.

Results of the studies reported in this paper indicate that, with the procedures followed, the extractive content and its toxicity, as measured by its effect on fungus growth in artificial culture, are inadequate for a precise evaluation of the decay resistance of selections of Black Locust.

31.41 : 12.26–8 (66.7) : 33.36.1. GOLD COAST. **Report on the Forestry Department for the year 1943–44.** Govt. Printer, Accra. 1944. pp. 6.

Tests made in Takoradi Harbour showed that Mahogany logs could not be left in sea water for more than six weeks without danger of teredo attack.

Creosoted and untreated specimens of *Chlorophora excelsa, Piptadenia africana, Lophira procera, Sarcocephalus diderrichii*, and *Gluema ivorensis* were placed in the harbour in order to study incidence of teredo attack. At the end of six months none of the creosoted specimens had been attacked, but of the untreated specimens only *Gluema* was unaffected (p. 2).

31.42. Attack by Plant Organisms

31.42.1 : 12.21. ULBRICH, E. **Über einige *Ophiostoma*-Arten und die Blaufäule der Nadelhölzer. [On some *Ophiostoma* species and the blue rot of conifers.]** *Notizbl. bot. Gart. Berl.* 15, 1941 (303–11). [G.] *Zbl. Bakt.*, Abt. 2, 106 (11–12), 1944 (230–1). R.A.M. 23 (368).

The conceptions of 'blue stain' and 'blue rot' are defined and differentiated. The former is caused by species of *Ophiostoma* or *Ceratostomella* which do not in the first place impair the durability of the wood; if, however, the latter is insufficiently dried before manufacture, the long-lived, black mycelia of the fungi may reappear and spoil the paint of window-frames, doors and the like. The term 'blue rot' should be applied only to the sapwood parasites, especially *Stereum* spp. and *Polystictus abietinus*, which frequently accompany or follow the staining fungi and are responsible for true decay.

31.42.1 : 31.43 : 38.2. **Results of inspection of emergency building projects for decay and insect damage.** U.S.D.A. Bureau of Plant Industry [Washington, D.C.] [1942.] pp. 5.

In general, recent frame construction is superior to that employed in temporary buildings erected during the first World War, but the larger proportion of sapwood in the lumber now being used and the moist character of some of the sites combine with certain of the present construction features to create a definite hazard from both decay and termites. The chief of these are: (1) Wood in contact with the soil, including the burial of form boards and scraps of lumber in the soil beneath buildings or adjacent to foundations; this offers opportunities for termites to build up large populations, and may also be a source of decay infection. (2) Increased use of masonry instead of poured concrete foundations, which may result in future difficulty with termites. (3) Failure to open in the spring the ventilators in floors of buildings, which have been closed during the winter, and misplacing of such ventilators; the best height for ventilators is probably just below the joists. (4) Heating plants or hot-air pipes beneath the floor in some situations favour moisture accumulation and decay. (5) Siding decay occurs where much sapwood is used and is backed by vapour-proof building paper such as asphalt felt. Measures for combating these dangers are suggested.

31.42.1 (213). SCHULZE, B. Mykologische Prüfung der Tropeneignung organischer Werkstoffe, insbesondere von Holz. **[Mycological testing of organic substances, particularly wood, for their suitability for use in the tropics.]** *Holz Roh- u. Werkstoff* 5, 1942 (345–50). [G.g.] P.R.

An account of experiments with various fungi which attack wood and other organic materials.

31.42.12 : 33.36.1 : 33.31. NARAYANAMURTI, D., and PANDE, J. N. **Note on sap stain and its prevention.** *Indian For. Leafl.* (*Utilization*) No. 68, 1944. pp. 7 + plate + tbls. [Forest Research Institute, Dehra Dun.]

A brief discussion of conditions favourable for the development of sap-stain fungi, the manner of infection, the properties affected by stain, and prevention and control measures, followed by the results of tests carried out with certain anti-stain chemicals. Of these,

antobrite (1 per cent.) and Lumbasan (0·25 per cent.) ere found to be the most efficient.

1.42.12 : 12.14.8 : 12.25 : 12.21. HAUSAM, W., and UNTARA, W. Mikrobiologische Untersuchungen an ichtenrinden. [**Microbiological studies on Spruce bark.**] *ollegium, Haltingen, 1943,* 1943(130–9). [G.] *Chem. bl.* I, 1944 (406). R.A.M. 23 (368).

From varicoloured deposit and brownish-red stains n Spruce bark, bacteria, yeasts, moulds and wood-habiting fungi were isolated, most of which induced milar strains on Spruce bark agar and changes in the annin, and more especially the non-tannins (sugars) in pruce bark emulsions, coupled with an increase in soluble constituents. Pentachlorphenol, raschit, nd trichlorphenol in appropriate concentrations in-ibited the growth of these organisms on Spruce bark, ith the exception of *Ophiostoma* [or *Ceratostomella*] *iceae,* to which the fungicidal observations do not pply, since it did not develop at all under the experi-ental conditions.

31.43. Attack by Animal Organisms

1.43 : 13.2 : 13.11 : 13.15. BECKER, G. Zur Ökologie nd Physiologie holz-zerstörender Käfer. [**On the cology and physiology of wood-destroying beetles.**] *Z. ngew. Ent.* 30, 1943 (104–18). [G.] Chem. Zbl. II, 943 (1998). D.S.I.R.

A detailed account is given of the most important ood-destroying beetles, including information on their fe histories and economic significance. There are 40 eferences.

1.43. KAVEN, G. Insekten als Holzschädlinge und re Bekämpfung. [**Insects as pests of wood, and their ontrol.**] *Desinfekt. u. Schädlingsbekämpf.* 35, 1943 55–7, 73–4, 78–80). [G.] Chem. Zbl. II, 1943 (1998). .S.I.R.

An account of the biology and mode of life of the ndividual pests and a review of the present position ith regard to control technique.

1.43 : 13.2. COZZENS, F. R. **Termite control.** *sbestos* 25 (8), 1944 (3–4, 6). P.O.

A promising substitute for creosote in the treatment f timber against attack by termites, marine borers, and ther insect pests consists of a wrapper of asbestos loth or asbestos paper applied over a coating of quick-rying asphalt piling paint containing asbestos as a inder.

1.43 (213) : 13.2 : 31.42 : 33.36.1. Gebäudeschutz urch tierische und pilzliche Schädlinge in den Tropen. [**The protection of buildings in the tropics against animal nd fungous pests.**] *Zbl. Bauverwalt.* 61, 1941 (498–501). G.] *Abstr.* in *Holz Roh- u. Werkstoff* 5, 1942 (217). .R.

Termites are of particular importance in the tropics, bout 2,000 species having been distinguished. This aper discusses the possibilities of minimizing the risk f attack by plant and animal pests with reference to roper ventilation, cleanliness in the vicinity of the uildings, and the use in building construction of urable timbers and metal shields, chemical wood reservatives, including coal-tar oil in combination ith petroleum, and preparations containing arsenic.

1.43 : 13.15 : 13.2. BECKER, G. Neuere Forschungs-rgebnisse über holzzerstörende Insekten. [**Recent esults of research on wood-destroying insects.**] *Abstr.* in *Holztechnik* 22, 1942 (287). [G.] P.R.

A comprehensive knowledge of wood-destroying insects and their environmental requirements is a necessary basis for investigations on control measures and on methods of protecting timber against attack. This paper collects data from recent research on the most important pests of manufactured timber. It deals particularly with climatic conditions, food requirements, predators and parasites, and with the biology of reproduction in so far as these factors affect control.

While *Hylotrupes bajulus* and *Ergates faber* can endure heat and thrive in a wide range of temperatures, favourable temperatures and the upper temperature range are comparatively low in the case of the most important furniture beetles (Klopfkäfer). Of all the native pests of timber the *Hylotrupes* larvae require the least amount of moisture in the wood, while *Ergates faber* demands a very high moisture content. Protection of wood against beetles by regulating temperature and moisture conditions is therefore very difficult. With regard to nourishment, however, the beetles are very dependent on their environment, since the larvae (in contrast to other insects which attack coniferous woods) rely entirely on the small protein content of the timber. A reduction in the protein content restricts or prevents larval development and gives the wood permanent protection, while a high protein content (e.g. in fresh squared timber) favours the development and spread of the pests. Attack by *Hylotrupes bajulus* is substantially affected by certain essential oils present in conifers. This knowledge points the way to means of control.

31.43 (67.6) : 13.2. KIRKPATRICK, T. W. **Notes on insect damage to East African timbers.** East African War Supplies Board, Timber Control, Nairobi, Kenya. 1944. pp. 31.

The Entomologist of the East African Agricultural Research Institute recently carried out a rapid survey of the timber yards at Dar-es-Salaam, Tangu and Mombasa, and a few sawmills in Kenya and Uganda; in this pamphlet he gives some information on East Africa timber pests and their habits, for the assistance of timber inspectors and managers of sawmills and timber depots. The principal types of damage are described and some account is then given of the beetles chiefly responsible, i.e. flat-headed borers (Buprestidae), round-headed borers (Cerambycidae), Ambrosia beetles (Scolytidae), powder-post beetles (Bostrichidae, Lyctidae and Anobidae). Other pests described are termites, carpenter bees, carpenter moths, bark beetles, shipworms. Measures for preventing or limiting damage by timber beetles are described and there are keys for the determination of the types of insect damage to timber and of the common insect pests of timber in East Africa.

31.43 : 13.2. FISHER, R. C. **Wood-boring insects in Beech furniture.** *Nature, Lond.* 155, 1945 (116).

Records of infestation by the *Lyctus* and *Xestobium* beetles show that neither normally occurs in Beech furniture. Two insects which do sometimes cause serious damage to Beech timber are the common furniture beetle (*Anobium punctatum*), the most frequent cause of 'worm' in old furniture, not only of Beech but also of many other woods, including Walnut, and, less commonly, *Ptilinus pectinicornus*, which also occurs in Sycamore and Willow. Of these, the first is by far the more important, and in the course of repairs to

valuable furniture the use of suitable preservative treatment for woods susceptible to attack by this insect is advisable to prevent a recurrence of the trouble.

31.45. Injury by Fire

31.45 : 38.1 : 33.36. 1. STEINER, A. J. **Fire-hazard classification of building materials.** *Bull. Res. Underwriters' Lab.* 32, 1944. pp. 34. Chem. Abstr. 38 (6512). P.R.

The results of preliminary fire-hazard classification tests are given for Red Oak, White Pine, Southern Yellow Pine, and Douglas Fir lumber, both untreated and treated by chemical impregnation or surface application. The results of tests with cellulose boards, plywood, felts and fabrics are included. Classification factors were established for maximum flame spread, fuel contributed and smoke density. The results are compared on a numerical basis with the performance of untreated Red Oak lumber classified as 100 and with asbestos-cement board classified as 0.

31.8. *Quality and Defects of Timber*

31.8 : 12.26–8 : 31.3 : 31.27. NILSSON, T., and JOHNSSON, H. **Widespread occurrence of frost heartwood in Beech during 1942.** *Svensk PappTidn.* 47, 1944 (13–5, 37–40, 64–7). *Bull. Inst. Paper Chem.* 15 (43). Chem. Abstr. 38 (6553). P.R.

From 70 to 90 per cent. of the middle-aged stands of Red Beech (*Fagus sylvatica*) logged in 1942 showed the defect of frost heartwood. Determinations of density, moisture, sugar content and aqueous extractives of representative samples of sap- and heartwood from sound and affected trees showed little differences in the values. Frost heartwood has a certain unfavourable influence on the strength properties of the woods but the effect is not sufficiently serious to impair their use. A theory is offered to account for the formation of frost or false heartwood.

31.8 : 33.36.3 : 07.7. MELBOURNE. **The measurement of case-hardening.** *Timberman* 46, 1944–45 (44, 46).

The degree of cupping of strips or boards sawn from lumber stock, as given by the reciprocal of the radius of curvature, is suggested as a suitable practical measure of case hardening, and an instrument that may be used for its direct measurement is described.

32. HARVESTING OF WOOD. LOGGING

32.2. *Felling and Related Operations*

32.21 (73) : 92 : 94.3. WEDDELL, D. J. **Who should control the forests? An historical study of Government regulation.** *J. For.* 42, 1944 (861–70). [George Foster Peabody School of Forestry, Univ. of Georgia, Athens, Ga.]

A fairly detailed historical account of Federal regulation of cutting on privately owned forest land in the United States up to recent times.

32.21 (67.6). UGANDA. **Forest Department. Annual report for the year ended 31st December, 1943.** Govt. Printer, Uganda. 1944. pp. 8.

A new form of cutting licence has been issued, by which a firm that has a permanent need for fuel may clear and purchase the fuel on some 2,500 acres of Crown forest, provided it establishes, and maintains satisfactorily, fuel plantations on all the land cleared. The firm may use the produce of these plantations free for 30 years, after which they revert to Government (p. 1).

32.25 : 07.7. **New mechanical saws.** *Pulp Paper Mag. Can.* 45, 1944 (906, 908).

Three new mechanical saws are announced. The Lombard Governor Corp., Ashland, Mass., has brought out a new time- and labour-saving 'Chain Lightning' electric and air power chain saw. The electrically-driven model weighs about 70 lb., the air-driven model about 50 lb. The Industrial Engineering Ltd. 'Beaver' one-man power saw weighs barely 30 lb. when fully fuelled. Precision Parts Ltd. have produced three models of a one-man chain saw weighing respectively 38 lb., 33 lb., and 38 or 45 lb.; all three are motor-driven.

32.25.5 : 33.3. HALE, J. D. **Experiment on the treatment of trees with chemicals to facilitate removal of bark.** *Pulp Paper Mag. Can.* 45, 1944 (615–8, 620).

An account of tests made by the Forest Products Laboratories of Canada at the Dominion Forest Experiment Station at Petawawa, on the treatment of trees with chemicals in order to prolong the period during which logs can be peeled beyond the limit of the natural peeling season. The process consists in the introduction of chemicals into the upward flowing sap of trees during spring and early summer with the object of killing the trees at this period, thus fixing the bark in such a condition that logs can be easily peeled thereafter, whether or not the tree is felled after the natural peeling season is past.

The experiments described were undertaken during 1943 on White Spruce (*Picea glauca*), Black Spruce (*P. mariana*), Balsam Fir (*Abies balsamea*), Jack Pine (*Pinus banksiana*) and the Aspen Poplars (*Populus tremuloides* and *P. grandidentata*). The chemicals used were two proprietary preparations 'Cambicide A' and 'Cambicide B', sodium chlorate mixed in different proportions with calcium chloride, ferrous sulphate (copperas), zinc chloride, copper sulphate, potassium dichromate, salt and a mixture of white arsenic and caustic soda, all in the form of pastes.

Two main types of reaction to the chemicals were observed in examining the standing timber during the summer. The very rapid action observable on the foliage within a week by the arsenic compound, Cambicide A and sodium chlorate, was generally distinct from the action of the other chemicals, which in some cases was such as to escape observation during the monthly examinations until the tree had been felled. In certain conditions, the wood in trees treated with chemicals of slow action seem likely to be drier than the wood in trees treated with chemicals more obviously destructive to foliage. By far the best effect in facilitating bark removal was observed as a result of treatment by quick-action chemicals. Observations suggest that ease of peeling in trees so treated is increased by storage. Experiments are continuing.

32.25.5 : 07.7. SHAW, E. C. **Barking wood with water. Construction and performance of streambarker.** *Pulp Paper Mag. Can.* 45, 1944 (896–8, 899).

A description of a newly designed barking machine constructed by the Allis-Chalmers Manufacturing Co., which operates by the direction of jets of water on the log. After numerous experiments it was found that the most effective results were obtained at a pressure of 650 lb. per sq. in., the jets being directed radially to the

centre of the log and at right angles to its length. Experiments on wood coated with ice and snow showed that there was no difference in the barking results. The use of a booster pump to raise the pressure to 750 lb. is recommended for handling some solidly frozen woods. The pump can be turbine-driven when electric current is not available. It has been found that, although the machine can handle logs varying from 4 in. to 18 in. in diameter, it works most efficiently when fed with logs of approximately the same size. A capacity of upwards of 10 cords an hour can be obtained throughout the year when handling Yellow Spruce (*Picea rubra*); hardwoods average about 6 cords an hour.

32.25.5 : 07.7. **Hydraulic slab barking.** *Timberman* 46, 1944–45 (47).

Slabs up to 12 in. wide and 2 ft. or more in length are barked by means of three jets of water delivered from the nozzles at 1,100 lb. pressure and at 450 gals. per minute.

32.29.2 (74) : 31.42.11 : 12.21. SPAULDING, P., and HANSBROUGH, J. R. **Decay of logging slash in the Northeast.** *Tech. Bull. U.S. Dep. Agric.* No. 876, 1944. pp. 22.

Slash can be disposed of by broadcast burning, which kills advance reproduction and causes site deterioration, or by burning in piles, which is expensive. The only practicable alternative is to leave slash to decay. This bulletin is based on systematic observations of slash decay in New York and New England over a number of years. It considers the fungi most important in causing decay in this area, the conditions which favour their activity, and the forest-management practices by which these favourable conditions can be provided.

32.9. *Transport*

32.91 : 07.7. LEVIE, C. G. **Suggested methods of icing logging roads.** *Pulp Paper Mag. Can.* 45, 1944 (971–2).

The water tanks used at present in Eastern Canada for icing hauling roads are usually inefficient; on the other hand, the cost of equipment specially built for the purpose would generally be prohibitive. The writer suggests that suitable equipment exists already in the form of distributors used for applying oils and tars to the surfaces of highways. These machines are used for perhaps two, or not more than three, months in the year, and are in storage during the whole of the winter period. It is suggested that logging companies might hire such machines for two or three months in the winter. In addition to tanking the road, the units could be used for snow-ploughing, as they are all mounted on standard trucks of 3 to 5 tons, to which snow-ploughs are easily attached.

32.91.22 (71.8). KOROLEFF, A. **Transporting fifty-ton loads of pulpwood by truck-trailer units in Newfoundland.** *Pulp Paper Mag. Can.* 45, 1944 (969–71).

The truck haul here described takes place over 14 miles of road from Hampden in White Bay, where the pulpwood is loaded in 2-cord bundles, to a landing at the Humber River, into which the wood is discharged to proceed by water to the mill at Corner Brook. The use of this road, the construction of which began in 1942, saves transportation of wood by ships over 375 miles. So far the construction of the road has cost about $6,000 per mile. It is expected that in 1945 the road will be in its final good condition throughout. Four Hayes trucks, Model SD 462 W, are used. The wood is handled in bundles of 2 cords each (9 ft. in diameter), and all truck-loads are made of 10 bundles, so that the net load is about 50 tons. The round trip of 28 miles normally takes three hours, including loading and unloading. Cost of trucking in 1944 was about $1.40 per cord, but it is hoped to reduce this to less than $1.00.

32.91.22 : 07.7. Suntetorp-släden. En praktisk vedkälke, som underlättar utkörningen av veden. [**The Suntetorp sledge. A practical wood sledge which facilitates the extraction of wood.**] *Skogen* 31, 1944 (32–3). [Sw.]

The sledge, which can be handled by one man, is upturned, attached to a load of wood by means of a metal frame and straps, and when righted is ready for hauling.

33. CONVERSION AND PRESERVATION OF WOOD

33.0. *Utilization Categories of Wood*

33.0 : 12.25–8 (931). NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

Successful substitutions of New Zealand grown timbers for both imported woods and other materials include:—Black-maire (*Olea cunninghamii*) both for Lignum-vitae for caulking mauls used in ship-work, and for Boxwood for buffing-blocks used in instrument spindles; Silver Beech (*Nothofagus menziesii*) for Walnut and Ash as packing-blocks for aeroplane spars, and for Sycamore in hosiery shapes; Insignis Pine (*Pinus radiata*) for metal and rubber water-bottle stoppers; and Matai (*Podocarpus spicatus*) for bushings in barrel bung-holes. Untreated Matai has been found to be much superior to other species for this purpose as it shows relatively little change in shape (pp. 20, 22).

33.06. Fuelwood (including Firewood, Charcoal Wood, and Producer Wood)

33.06 (73) : 98.1. FITZWATER, J. A. **The national fuelwood situation.** *J. For.* 42, 1944 (925–6).

A recent analysis of the national fuelwood situation made by the U.S. Forest Service indicates that while the outlook for the winter of 1944–45 was somewhat brighter than that for the previous year, there was still an estimated deficit of over 4 million cords, or about 6 per cent. of estimated needs, compared with an estimated deficit of 15 per cent. for the previous year. The improvement was largely due to the exceptionally mild winter of 1943–44 and the increasing change-over to coal and oil.

33.06 (945). YOUL, J. W., and MOULDS, F. R. **Firewood utilization in Victoria.** *Aust. For.* 8, 1944 (31–9).

The average annual consumption of firewood in Victoria per head of the population is about ¾ ton. There was before the war some sign of a change-over to the use of brown coal briquettes. Such a change would be very detrimental to forestry interests, and a possible solution is the more extended use of the latest types of wood-burning heaters. Reports of similar trends in Sweden, Switzerland, France and Austria, are quoted.

33.13. Cooperage

33.13 : 33.91. LAHEY, R. W. **Packaging.** *Chem. Engng. News* (*News Ed.*) 22, 1944 (940, 942, 945). P.O.

Grade rules and specifications are given for slack barrel staves, stave dimensions, Ash staves, coiled Elm hoops, and slack barrel headings as adopted by the Slack Cooperage Group of the Associated Cooperage Industries of America, Inc.

33.14. Match Manufacture

33.14 (54). **The match industry in India.** *J. Coun. sci. industr. Res., India* 3 (1), 1944 (26–36). A.G.S.

The history of the industry is traced and the economics and the manufacturing processes used are fully discussed. The best indigenous species is said to be Semul (*Bombax malabaricum*) which used to be considered a forest weed and sold for 3–4 annas per tree, against the present price of Rs. 12 to Rs. 15. The present average output is 18 million gross of boxes of 60 matches per annum. The timber requirements are 10·5 cu. ft. per 100 gross of boxes when using the best indigenous species, but only 7·3 cu. ft. per 100 gross of boxes when using imported Aspen.

33.15. Manufacture of Veneers, Laminated, and 'Improved' Wood. Gluing

33.15 : 38.1 : 33.32. CHAMPION, F. J. **Wood comes of age.** *Sci. Mon., Wash.* 58, 1944 (195–206). P.O.

This article discusses some of the recent developments in the manufacture and treatment of wood that have so greatly extended the use of this material, particularly in the structural field. Amongst these developments are water-resistant, phenolic-resin glues for structural plywoods, timber connectors and glued laminated arches for heavy timber construction, moulded plywood for aircraft and marine structures, and improved wood and plastics (impreg, compreg, hydroxylin, papreg and uralloy).

33.15. GRAFTON, C. M. **Bonding metal to wood.** *Mod. Plastics* 22 (1), 1944 (103, 194, 196). P.O.

Adhesives have been developed that give a bond of maximum strength between metal and any type of wood without the need of baking at high temperatures. The method of applying the adhesive is described and results of tests on the bond strength are given in this paper.

33.15 : 38.1 : 31.27. **Prefabrication and plywood.** *Brit. Plastics* 16 (179), 1944 (144–7). A.G.S.

A brief description of certain 'Uni-Seco' resin bonded plywood prefabricated building units is given, and the failing loads from tests on columns and beams are recorded in tons with no quotation of the size of the units tested.

33.15 (54). KAPUR, S. N., and DATTA, S. **Plywood industry in India.** *J. sci. industr. Res. India* 3, 1944 (167–77). A.G.S.

The history and the economics of the industry are briefly recorded and a suggested list of machinery required to equip a small mill is given. The raw materials (timber and glue) are discussed in detail and the article concludes with a table giving the sources of supply, the peeling characteristics, and notes on 54 Indian timbers found suitable for the manufacture of plywood.

33.15. **Fibre-faced plywood.** *Timberman* 45, 1944–45 (70, 72).

Details of a new product, Super-Harborite, consisting of a Fir plywood core with phenol type resin-impregnated fibre faces. It is weatherproof and boilerproof, and can be worked with the usual tools and fastened with nails, bolts or screws. The surface will take paints, lacquers or other finishes. Details of the manufacturing process are given.

33.15 : 31.27. BALABUKH, L. I. **The stability of plywood plates.** *Aeronaut. Engng. U.S.S.R.* 11 (9), 1937 (19–38). *R.T.P. Transl.* No. 2199. A.G.S.

The critical buckling stresses in plywood panels under various types and directions of loading are mathematically derived. Expressions are also given for the stringer and rib spacing on wings, for the 'no buckling under likely service loading' condition.

33.15. BRUMLEVE, C. C. **High frequency molding of plywood cylinders.** *Timberman* 46, 1944–45 (68, 70, 72, 74, 76, 78).

The method described makes use of a Thermex high-frequency unit and the patented 'Gramwood' process that has been developed by the Jasper Wood Products Company of Jasper, Indiana.

33.15. **Plywood repairs.** *Aircraft Prod.* 6, 1944 (528–30). A.G.S.

For applying pressure to glued patch repairs in plywood skins, a flexible rubber pad with a grid of air passages on its underside is placed over the patch and its edges are fixed to the skin with adhesive tape. By exhausting the air space under the pad a pressure of up to 14·7 lb./sq. in. may be applied to the joint. Heater elements vulcanized into the pad provide a satisfactory temperature for gluing when working at a power factor of 1·6 watts per sq. in.

33.15. CROUET, M. F. (vested in the Alien Property Custodian). **Compressed plywood assemblies.** *U.S. Patent* No. 2,350,729, June 6, 1944. Chem. Abstr. 38 (5032). P.R.

Use is made of alternate unimpregnated plies and impregnated plies containing throughout their structure a polymerizable resin and having a thickness several times the thickness of the unimpregnated plies.

33.15 : 33.32. **A new product of the forest.** *Sth. Lumberm.* 169, 1944 (54, 56).

The new material, known as 'Inderon', consists of an inner structure of Douglas Fir plywood faced with a 3-ply indurated film of fibrous phenol formaldehyde. This product appears to have a relatively high resistance to vapor permeation, water absorption, abrasion, and fungus and insect attack, and is finding many applications. It is available in thicknesses ranging from $\frac{5}{16}$ in. to $\frac{3}{4}$ in. and in sizes up to 48 × 120 in.

33.15 : 33.36.3. REHMAN, M. A. **Conditioning chamber for plywood.** *Indian For. Leafl.* (*Utilization*) No. 65, 1944. p. 1 (Plan).

Dimensioned drawings of section, elevation and plan of the conditioning chamber are given.

33.15 : 31.1. HARLOW, W. M. **The microstructure of high-density plywood.** *Repr.* from *Mech. Engng.* October, 1944. pp. 2. L.C.

High-density wood ('compreg') can be successfully sectioned following treatment in a 10 per cent. hot aqueous solution of sodium hydroxide. From samples examined there appear in general to be two alternating zones (1) of maximum impregnation and (2) of maximum compression as indicated by tissue distortion. Usually the zone of greatest penetration is along the original veneer sheet, in which case the greatest compression occurs near the centre of the sheet.

33.15 (73). **Government specifications for plywood and adhesives.** *Bull. resin. Prod. Chem. Co.* No. 5, 1943. pp. 18. P.R.

Adhesive requirements, test procedure, and adhesives recommended are given for each of a number of basic and departmental specifications of the U.S. Government under which plywood is being purchased for war purposes.

33.15. **Casein type adhesives for plywood manufacture.** *Mon. News Lett. Div. For. Prod. Aust.* No. 133, 1944 (2).

Tests have shown that peanut meal ground to a fine flour, buttermilk, or milk albumen can be used in mixture with casein to give a satisfactory adhesive, thus conserving supplies of the latter material.

33.15. RUST, S. F. **'Wet-mix' casein glue ingredients.** *Aust. Timb. J.* 10, 1944 (409, 417).

It is most important that only the best quality ingredients should be used for 'wet-mix' casein glue in order to produce a satisfactory mixture. Casein should be of prime lactic quality, and a good grade of finely powdered lime should be used. If the lime has been exposed to the air and calcium carbonate developed from the calcium hydroxide, difficulty will be found in obtaining a proper glue mix. Care should also be taken to ensure that the proper grade of sodium silicate (waterglass) is used. Two types are commonly available, the so-called neutral grade and the alkaline grade; some formulae employ one and some the other.

33.15. NARAYANAMURTI, D. **Some ground-nut protein glue formulae and their application.** *Indian For. Leafl. (Utilization)* No. 67, 1944. pp. 5. [Forest Research Institute, Dehra Dun.]

This leaflet describes briefly ground-nut protein glues and the ingredients required to make them. Three chosen formulae are given and the method of preparation of the glues according to these formulae, and their subsequent application in the manufacture of plywood, are described in some detail.

33.15. **Edge gluing and taping of plywood veneer.** *Bull. resin. Prod. Chem. Co.* No. 6, 1944. pp. 10. P.R.

33.15. VAN EPPS, C. F. **Resinous wood bonding adhesives.** *Timber of Canada* 5, 1944 (37–8, 40, 58, 60, 62).

A fairly detailed account of the synthetic resin adhesives in general use for wood bonding, and of their relative advantages for particular uses. The bonding processes are also described.

33.15. DEICHMÜLLER, F. Holzverbindung durch elektrisches Leimen. **[Wood bonding through electrical gluing.]** *Holz Roh- u. Werkstoff* 5, 1942 (203–5). [G.g.] P.R.

A review of methods of accelerating the setting of glues by means of current-bearing metal conductors and of gluing processes involving the use of electrical high-frequency fields.

33.15. HARKOM, J. F. **Gluing wood.** *Timber of Canada* 5, 1944 (46, 49).

One of the most useful properties of resin glues is that the time of setting may be reduced to a few minutes by the application of heat. This applies to cold-press, medium-temperature, and hot-press glues. Details are given of some experiments in which the necessary heat was applied by passing a current of 8 to 10 amperes through a number 28-gauge copper wire embedded in the glue line.

33.15. **New plywood gluing process.** *W. Cst. Lumberm.* 71, 1944 (76).

The new process known as the 'No Clamp Cold Press Gluing Process' has been developed by I. F. Laucks, Inc., and makes use of Lauxein soybean 'No. 90 × No Clamp' glues. The process does away with the need for all irons and retainer clamps in the production of cold-press Douglas Fir plywood.

33.15 : 31.27. DIETZ, A. G. H., and GRINSFELDER, H. **Fatigue tests on compressed and impregnated laminated wood.** *Bull Amer. Soc. Test. Mat.* No. 129, 1944 (31–4). A,G.S.

Rotating beam tests were made on test specimens to U.S. Federal Specification LP. 406 (·33 in. dia. test section), rectangular section specimens being used for the modulus of rupture control tests. Of the eleven materials tested eight gave an 'Endurance Limit to Static Modulus of Rupture' ratio of ·28 to ·30; one, the only cross-banded specimen, gave a ratio of ·25, and for two Maple veneer specimens bonded with 'Low Polymer Type A' the ratio was ·38. A dimensioned drawing of the specimen and S–N curves for each material are included.

33.15 : 33.3. **New wood treating chemical christened 'Arboneeld'.** *B.C. Lumberm.* 28, 1944 (68–9, 74).

An account of a new process of impregnating wood with resin-forming methylolurea and the conversion of this chemical resin within the wood [cf. *For. Abstr.* 5 (99)]. The treatment, which is simple and inexpensive, is described, together with the equipment needed. Methods of working transmuted wood differ from those for untreated wood somewhat as do methods of working steel and iron. Treated wood may require slower rates of sawing, cutting and turning, harder tools or more frequent sharpening of tools.

Although some 300 species of trees are found in Canada, not more than 30 or 35 are used commercially. Some are not used because they are too soft or weak, or crush or dent too easily, are not durable, or present working, turning or finishing difficulties. The new process will bring many of these within the range of usefulness, many even to the point of supplanting less available and costlier woods.

33.15 : 31.44. **Transmuted wood may have a place in chemical equipment.** *Chem. metall. Engng.* 51 (5), 1944 (132). L.S.

Data are given to show the increased resistance to chemicals of wood that has been treated with methylolurea resin.

33.15 : 31.27. **High density wood.** *Bull. resin. Prod. Chem. Co.* No. 7, 1944. pp. 12. P.R.

The principal types of high density wood products that have been developed in the United States so far, chiefly in laminated constructions, are Tegowood, Amberwood, Compreg and Impreg. The materials and the process used in the manufacture of each are described, and data are given comparing the characteristics of the first three products.

33.16. Wood-wool (Excelsior) Manufacture

33.16 (485). HARTELIUS, H. **Om träull och träullstillverkning. [Wood wool and its manufacture.]** *Skogsägaren* 19, 1943 (130–2). [Sw.]

A detailed description is given of the process of manufacturing wood wool. Pine or Spruce pulpwood

is generally used, more rarely Aspen; Spruce is superior to Pine, as it yields a whiter wool. For this purpose the wood must be dry, as blue stain impairs the quality of the product. R. P. J.

33.17. Sawmilling

33.17 (75.4–7) : 98.1. CRUIKSHANK, J. W. **Power units at small sawmills in the Appalachian hardwood region.** *Sth. Lumberm.* 169, 1944 (60, 62–3).

In 1942 about 80 per cent. of the lumber produced in the Appalachian hardwood region was cut by small sawmills with an annual production of less than 5 million board feet. Power installations ranged from waterpower to the most efficient types of electric, steam or Diesel engines. Data are tabulated showing (1) the number of sawmills and lumber production by mill class in 1942, (2) the kind of power used, (3) the total number of power units used, (4) the type and average horsepower of power units, (5) the distribution of power units by horsepower class, and (6) the distribution of power units by age.

33.17 (931). NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

In its third year of operation the State-operated log-frame sawmill at Waipa produced over 9 million bd. ft. sawn timber, more than 3 times that of the next largest Insignis Pine mill. The original objectives of this mill were: (*a*) the sorting of logs by sizes and sawing each group on a mass production basis; (*b*) the reduction of waste to a minimum and securing the largest possible yield of sawn timber per cu. ft. of log; (*c*) accuracy of sawing in order that machining and fabrication may be done with a minimum of waste in wood-using factories; (*d*) the drying and merchandising of timber in such a way that it can compete on a quality basis with imported timbers. These objectives have been attained with the mill working on an economic basis at present price levels. The log frames have been found to be ideally suited for the conversion of logs having a 'sweep'—amounting to some 50 to 70 per cent. according to species and site. In comparison with recovery from such logs by circular sawing, that by log-frame sawing shows an increase of 20 per cent. with consequent reduction in waste (pp. 11, 15).

33.17 : 07.7. HAYCOCK, A. H. **Principles of machine woodworking. Dimension saws.** *Wood* 9, 1944 (277–80).

33.3. *Chemical Treatment*

33.3. LOUGHBOROUGH, W. K. (to the people in the territory of the U.S., for free use). **Improving the flexibility of wood, as for curving or other desired shaping.** *U.S. Patent* No. 2,343,016, Feb. 29, 1944. Chem. Abstr. 38 (4771–2). P.R.

Wood, such as Sweetgum veneer, is first saturated in an aqueous urea solution (which may be of saturated strength) at room temperature, then dried to a weight which is in equilibrium with 60° and 40 per cent. relative humidity, then, in the form of veneer or boards, subjected to a temperature of about 175° and a pressure of about 500 lb. per sq. in., then cooled to about 60° while the pressure is maintained, shaped to any desired form, and finally treated to resinify the imbibed urea by treatment with an aldehyde, as with CH_2O.

33.32. Pulp and Paper Manufacture. Plastics

33.32 : 31.3 : 12.25 : 12.26–8. JAYME, G. **Eigenschaften und Verwendungsmöglichkeiten von Zellstoffen aus verschiedenen europäischen Hölzern in Abhängigkeit von ihrem chemischen und morphologischen Feinbau. [Characteristics and possible uses of pulps from various European woods in relation to their chemical and morphological structure.]** *Abstr.* in *Holztechnik* 22, 1942 (286–7). [G.] P.R.

The strength of paper pulps made from wood is determined first of all by morphological factors such as the thickness of the fibre walls and the length of the individual fibres, and then by chemical factors such as the degree of polymerization of the cellulose, lignin and hemicellulose contents of the pulp, as is shown by comparing the properties of sulphate and sulphite pulps from Beech, Poplar, Spruce and Pine woods. The uneven distribution of the lignin, which has a protective effect on the cellulose within the cell walls during the disintegration of the wood and the bleaching of the pulps, is one of the reasons for the different results from disintegration by the sulphate and sulphite processes. In this respect there are very great differences between broadleaved and coniferous woods. In addition, changes in the chemical structure of the wood take place with age. The nature of these changes is not yet known, but they result in higher yields of cellulose and pulp from older than from younger woods, as is demonstrated by the comparative disintegration of one- and ten-year-old Poplar by the sulphate and sulphite processes.

33.32 (213). GERLAND, H. **The behaviour of wood-flour-filled phenol resins in humid, hot, tropical climates.** *Siemens-Z.* 23, 1943 (23–7). [G.] *Chem. Zbl.* II, 1943 (1057). Chem. Abstr. 38 (6006). P.R.

Under tropical conditions the formation of AcOH and NH_3 by decomposition causes the corrosion of metal inserts or built-in metals. Laboratory corrosion tests indicate that for tropical use plastics should be made from softwood (Spruce). The mixtures should contain at least 50 per cent. of resin; high MgO contents and excessive quantities of hexamethylene-tetramine should be avoided. Rapidly hardening resols without NH_3-forming hardening accelerators are suitable. AcOH and NH_3 values should not exceed 0·18 and 0·15 per cent., respectively.

33.32 : 34.6. SCHWARTZ, H. **The utilization of lignin in plastics.** *Pulp Paper Mag. Can.* 45, 1944 (675–8).

A review of the literature on developments in the use of waste lignin in plastics. It is concluded that the solution of the problem of waste lignin will be solved not so much by its use in moulding powders as in low-priced laminated and compressed products. Seventy references are given in the bibliography.

33.32 : 34.6. JAHN, E. C. **Research and development in wood and lignin plastics.** *Svensk PappTidn.* 46, 1943 (491–3). [E.] [N.Y. State College of Forestry, Syracuse Univ.] P.O.

The processes that have been developed so far for treating wood and agricultural wastes to form plastics are accomplished by (1) thermal hydrolysis with water, (2) acid hydrolysis, or (3) chemical condensation with phenols, aldehydes, etc. Each of these processes is noted briefly as is also that involved in the isolation of lignin from waste cooking liquors from pulping wood.

The general conditions required for moulding lignocellulose powders are noted, together with the properties of the moulded products.

33.32 : 31.1 : 31.3. JAYME, G. Neuere Pflanzen-Aufschluss- und Veredlungs-Verfahren. **[Modern methods for the processing and refining of plant materials.]** *Chemie* 55, 1942 (323–8). [G.] D.S.I.R.

The strength properties of pulp are chiefly dependent upon the morphological structure and chemical composition of the individual fibres. Only one of these properties, namely tearing strength (Fortreissfestigkeit) is materially affected by fibre length; the thickness of the fibre walls has a much more important influence on all other strength properties. The significance of cellulose, lignin and the hemicelluloses, and of the thickness of the fibre walls on the strength properties of the pulp is discussed.

The latter part of the paper deals mainly with the sodium chlorite method of pulp manufacture for paper and with the process of prehydrolysis for the production of artificial fibres.

33.32. BOEHM, R. M. **Development in the manufacture of structural products from hydrolyzed wood.** *Paper Ind.* 26, 1944 (242–4, 253). L.S.

A brief account is given of the Masonite process, of the raw materials used and the products and by-products normally obtained therefrom, and of the uses and properties of new types of products developed from this process to meet war-time requirements.

33.32. SIMMONDS, F. A., MCGOVERN, I. N., and SEBORG, C. O. **Weatherproof solid fibreboard.** *Sth. Pulp Pap. J.* 7, 1944 (16–20).

Tests were made to compare the quality of commercial weatherproof solid fibreboards with improved experimental boards. The best experimental boards, made from either commercial Jack Pine or Southern Yellow Pine kraft pulps were, when wet, twice as rigid, three times as strong in core strength, and, at equilibrium, absorbed from 25 to 51 per cent. less water than did the commercial boards having the best values for these properties. The improvements in the experimental boards were the result of employing a wet-strengthening treatment, the use of a greater number of individual plies having higher dry strength than those used in the commercial boards, and the consequent increase in the amount of weather-resistant adhesive used in laminating the solid fibreboard.

33.32 : 34.6. PATERSON, A., LUBICZ, L., and MANIFOLD DEVELOPMENTS LTD. **Wood composition board.** *British Patent* No. 553,609, May 28, 1943. Chem. Abstr. 38 (5379).

Wood composition board is produced from untreated wood waste consisting of fragments or particles, by intimately mixing these wood fragments or particles with a limited quantity of a synthetic phenol plastic or a synthetic amino plastic to serve as a binder, and molding under conditions of pressure and temperature.

33.36. Preservation of Wood. Seasoning and Drying

33.36.1. *Preservation against Attack by Plants and Animals*

33.36.1 : 31.43 : 13.2. GARDNER, J. C. M. **A note on the protection of timber from certain borers.** *Indian For. Leafl.* (*Entomology*) No. 69, 1944. pp. 4. [Forest Research Institute, Dehra Dun.]

This leaflet briefly describes preliminary tests of two methods for giving at least temporary protection against attack of powder-post beetles in cases where standard methods cannot be applied:—

(1) A mixture of creosote and fuel oil applied externally definitely prevents attack for at least nine months and probably for much longer.

(2) A coating of lime wash gave complete protection over a period of 3 months when liability to attack was serious.

The two methods are suitable for timber that is protected from rain. In each case treatment must be applied within a short period of cutting or sawing. *From author's summary.*

33.36.1 : 33.53. STACEY, W. A. **Proper treatment of field cuts will prevent needless decay.** *Wood Pres. News* 22, 1944 (102–5, 108). P.R.

Wood preservatives do not usually penetrate to the centre of structural timbers and piles; thus cut-offs and bolt holes made in the field often expose untreated portions of the timber which in time usually decay. Methods of protecting these surfaces are discussed briefly.

33.36.1 : 12.26–8 : 33.36.3. GOLD COAST. **Report on the Forestry Department for the year 1943–44.** Govt. Printer, Accra. 1944. pp. 6.

Unseasoned poles of *Strombosia pustulata* treated with tanalith had to be rejected after 35 months, whereas poles given a similar treatment after proper seasoning were comparatively undamaged at the end of that period (p. 2).

33.36.1 : 12.26–8. NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

Tests have shown that under conditions of water immersion and high humidity, a useful degree of repellence and a reduction in the serious surface-checking characteristic of untreated and painted Rimu (*Dacrydium cupressinum*) plywood can be obtained by dipping in a hot solution of copper oleate and wax in a fuel oil (p. 22).

33.36.1 : 33.36.3. VAUGHAN, J. A. (to Southern Wood Preserving Co.) **Conditioning air-seasoned or partially air-seasoned wood such as that of poles, piles or crossties for treatment with preservatives.** *U.S. Patent* No. 2,350,845, June 6, 1944. Chem. Abstr. 38 (5378). P.R.

To facilitate desired impregnation by, and retention of, a preservative, e.g. coal-tar creosote or the like, timber which is at least partially air-seasoned is subjected to a steam and vacuum treatment, then to air pressure and treatment with water to penetrate the sapwood, followed by release of pressure and introduction of the preservative before the retained moisture dries out.

33.36.1. ANDERSSON, Y. Impregnering av träsilor med arsenik- och kopparhaltiga impregneringsmedel. **[Wooden silo preservation with arsenic- and copper-containing preservatives.]** *Landtmannen, Uppsala* 28, 1944 (705–7). [Sw.] R.A.M. 24 (41).

The results of analyses made in connexion with experiments in the preservation of wooden silos in Sweden with arsenic (pressure and open-tank methods)

and copper (cuprinol) indicated that the latter can safely be used without the least risk of poisoning livestock by consumption of the stored fodder. In the case of arsenic, however, the danger of adverse effects on health, especially of poultry, is not altogether negligible, and it is recommended that the inner walls of silos thus treated should be painted with a tar or asphalt solution to prevent the leaching-out of the chemical from the wood.

33.36.1 : 33.31 : 31.42.12. AINLEY, A. D., SHARP, F. L., and IMPERIAL CHEMICAL INDUSTRIES LTD. **Treatment of timber, seeds and tubers.** *British Patent* No. 546,493, July 16, 1942. Chem. Abstr. 37 (5545). P.R.

Sapstain and surface mold in cut timber is prevented by treatment with preparations containing as active ingredients bis(arylmercuri) ammonium salts of the general formula $(RHg)_2NH_2X$, in which R is Ph, tolyl, xylyl or naphthyl and X stands for the anionic residue of a mineral or other acid strong enough to yield a water-soluble product.

33.36.1 : 33.31. NOWACK, A. **The impregnation of wood.** *Bautechnik* 20, 1942 (172–6). *Chem. Zbl.* II, 1942 (2552). Chem. Abstr. 38 (3105). P.R.

Owing to the present shortage of certain salts, treatment of wood with solutions of different waste products of the petroleum industry, coumarone resin, phthalate resins, etc., in trichloroethylene were tested. The treatments are satisfactory. The solvent can be recovered.

33.36.2. *Fireproofing*

33.36.2 : 33.15. **Flameproof plywood developed for Navy.** *Sth. Lumberm.* 169, 1944 (57).

A new method of fireproofing finished plywood has been discovered, which does not in any way impair its strength or other qualities. A piece of plywood $\frac{3}{8}$ in. thick can be subjected to temperatures of 1200° F. for 20 minutes, and though the side exposed to heat chars, the other side does not discolour. Details of the process are not given. It is intended for use by the United States Navy.

33.36.3. *Seasoning. Drying*

33.36.3 : 12.25 : 31.27. **Popular misconceptions refuted in kiln-drying tests on Sitka Spruce at Vancouver Laboratories.** *B.C. Lumberm.* 28, 1944 (72–3).

The commonly held belief that kiln drying of Sitka Spruce for purposes of aircraft construction produces material inferior in strength to the air-dried product has now been refuted by tests recently completed at the Vancouver Laboratories of the Forest Products Laboratories of Canada. An account of the investigation is given, together with 4 kiln schedules used. The conclusions reached are as follows:—Kiln drying of Sitka Spruce, using proper schedules, properly controlled, will furnish material equivalent to that produced by careful air drying, in so far as the mechanical strength properties are concerned. There is a limit to the temperature which may be employed in kiln drying Sitka Spruce without strength impairment, even when a high relative humidity is used. For material used in aircraft construction this limiting temperature was found to lie between 150° and 160° F. A temperature of 170° F. is too high; it results in casehardening and very slow drying, accompanied by a marked loss of strength in compression parallel to the grain. There is no evidence that excessive brashness was developed by any of the schedules used. Recommendations are made as to which of the schedules given should be used for particular purposes.

33.36.3 : 07.7. **New moisture meter.** *B.C. Lumberm.* 28, 1944 (60).

A quick reading, automatic moisture indicator has been developed by the Colloid Equipment Company, New York. Known as the Delmhorst Moisture Detector Model R, it covers a range of from 7 to 25 per cent. moisture, with a claimed accuracy of $\pm$ 1 per cent. It is a completely self-contained unit, for use on lumber, wood products and various construction materials. The electronode needles are forced into the material to be tested and the reading is then taken by simply turning the dial knob until a small light above the dial flashes at the correct moisture content.

33.36.3. ANDERSON, C. M. **Avoiding kiln drying defects.** *Aust. Timb. J.* 10, 1944 (274, 277, 291).

A general discussion of some of the problems arising from kiln drying of timber, illustrated by three different schedules for the drying of 2-inch, clear, green Oregon Pine (*Pseudotsuga taxifolia*), of which one is recommended. It is emphasized that 'forced' drying with poor results is not as economical as slower drying with good results.

33.36.3 : 33.31. BERLINER, J. F. T. (to. E. I. du Pont de Nemours and Co.). **Wood seasoning with urea solution.** *U.S. Patent* No. 2,346,286. April 11, 1944. Chem. Abstr. 38 (5058). P.R.

To an aqueous urea solution containing 40–60 per cent. by weight urea, is added 0·5–5·0 per cent. by weight of the solution of a thickener which may be a starch, gelatin, glue, polyvinyl acetate, gum arabic, tragacanth, cellulose ether, soybean protein, etc. The viscosity of the wood-seasoning solution should thus be brought to at least 0·5 min. (Parlin # 7 cup).

33.36.3 : 34.26. **Solvent seasoning.** *Timberman* 46, 1944–45 (94,96).

Experiments are being made in a pilot plant of the Western Pine Association to test the commercial possibilities of a new method for removing water, oils and resins from Pine lumber by the use of solvents such as acetone. The lumber is placed in a vapour-tight extractor, sprayed for some hours with acetone heated to 180° F., and then dried by circulating hot air. Tentative schedules are given as follows: 4 × 4 in. stock should be commercially dry after a treatment of six hours in the spray bath and four hours of blower treatment; 8 × 4 in. stock is expected to require 10 hours spray and six hours blower treatment.

The treatment does not impair the physical properties of the wood, the only effect being a whiter wood of improved appearance and stability. Recovery of acetone from the system is expected to be better than 99 per cent., and it is believed that the recovery and utilization of residual oils and tars from the process will pay the cost of the operation.

33.36.3 : 33.15. RUSSELL, G. F., and MANN, J. W. **Radio frequency technology in wood application.** *Timberman* 45 (4), 1943–44 (106–8); (5) 1943–44 (60, 62–3, 66); (6) 1943–44 (64, 70).

It is shown that R.F. heating will always give a higher temperature at the centre of a block of wood than at its surface and the reason is explained. The relative merit of various 'glue line/electrode' arrangements is discussed and various possible electrode

shapes suggested. In conclusion, the singular advantages of using R.F. heating in conjunction with a normal seasoning kiln are outlined.

33.36.3 : 33.15. RUSSELL, G. F. **Wood drying and laminating by radio frequency.** *B.C. Lumberm.* 28 (8), 1944 (28, 38, 40).

'Hi Temp' drying, in which R.F. heating follows a short period of kilning, is discussed and the results of small-scale trials are quoted. Notes on laminating lay emphasis on the advantages of parallel bonding for glues polymerizing at temperatures below 212° F. [See also *Timberman* 45 (10), 1943–44 (38, 40, 42).]

33.36.3 : 07.7. **Can radio frequency be used in drying lumber?** *W. Cst. Lumberm.* 71, 1944 (74).

The subject was discussed at a meeting of dry kiln operators, who considered that radio frequency in conjunction with kiln drying was a future possibility, though it had so far only been tried out on small samples of timber. Further research is needed to discover the applications of the technique to wood seasoning.

33.37. Distillation. Manufacture of Tar

33.37. STENBERG, O., WILBERG, K. V., and HELLSTRÖM, N. **Characterization of wood tars.** *IVA* 1942 (12–30). *Chem. Zbl.* I, 1943 (236). Chem. Abstr. 38 (3113). P.R.

The dry distillation of various kinds of wood (Pitch Pine, Scotch Pine, Spruce, Birch and Beech wood) was carried out in a gas-heated oven provided with a suspended basket; the distillation products were first cooled in an air-cooled worm and then in a water cooler, so as to remove condensible products. The liquid products were analysed by steam distillation, in which the following groups were separated (these are recommended for general use): soluble tar, volatile oils (raw turpentine), residual tar (not volatile with steam and insoluble in water), as well as volatile water-soluble substances. The soluble tar yield, dry basis, is fairly constant, but the residual tar yield varies widely (highest yield with Pitch Pine, lowest with Beech). The residual tar probably consists largely of resinous and lignin tar, the soluble tar of polysaccharides. Yields were compared with those from commercial ovens. Viscosity measurements were plotted on a ternary diagram.

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-Gas Generators

33.38.2 (945). **Report on investigation of the technical and economic aspects of the manufacture of charcoal briquettes for mobile gas producers.** State Electricity Commission of Victoria, Melbourne. 1943. pp. 106.

A detailed report on the materials, equipment and methods used in the preparation and testing of pitch-charcoal briquettes for use in mobile gas producers. The main characteristics of the briquettes, as shown by road tests covering about 2,000 miles, are summarized as follows:—

(1) Their bulk density is about twice that of average charcoal.

(2) In any producer unit they will give more than twice the mileage obtainable with charcoal.

(3) The briquettes are much cleaner and easier to handle than charcoal.

(4) The process of manufacture corrects defects arising from incomplete carbonizing of charcoal.

(5) With proper control in manufacture, pitch-charcoal briquettes should provide a mobile gas-producer fuel reliable for uniformity in quality and performance.

(6) With the facilities available for the manufacturing experiments that have been made, carbonizing or baking to remove tarry matter from the pitch binder has been possible up to 500° C. and between 900° and 1,000° C. Those baked at the lower temperature have reactivity and starting-up periods about the same as charcoal, but are not as resistant to attrition as those produced at the higher temperature which results in lower reactivity and longer starting time. It is considered that at some temperature between 500° and 900° C. the most satisfactory compromise would be found.

(7) The briquettes have so far shown more dust in the producer and cleaners than arises from first-grade charcoal, and the starting-up period is perhaps slightly longer.

33.38.2 (68) : 07.7. HARTIG, R. D. **Producer gas charcoal.** *Off. J. Dep. Comm. Ind., S. Afr.* 5, 1943 (149–51).

War-time research on the manufacture and use of producer-gas charcoal has resulted in various improvements, some of which are indicated. A new type of brick kiln has been designed which produces charcoal of high uniform quality conforming to the strictest specifications for producer-gas charcoal. It is simple and inexpensive to build and no great skill is demanded in its operation [cf. *For. Abstr.* 6 (105)]. Yields of acetic acid and methyl alcohol as by-products from charcoal manufacture have been too low to encourage commercial exploitation.

The choice of timber species suitable for carbonization deserves consideration. Conifers yield a soft charcoal which is unsuitable for use in portable producers owing to the excessive development of dust. Woods with adhering bark are also of little value, since the inclusion of bark materially increases the ash content of the charcoal.

A new crusher has been developed which has a large output, produces no oversize material, and reduces the loss in fines to 8–10 per cent.

33.38.2 : 34.6. MÜLLER, B. Die Holzvergasung: Wesen, Zweck und Bedeutung für die holzverarbeitenden Betriebe. [**Wood gasification: nature, aim. and significance for the wood working industries.**] *Holztechnik* 22, 1942 (253–5). [G.] P.R.

The availability of wood waste in the wood-working industries often makes it profitable to introduce plant run on producer gas. It is now possible to construct wood-gas generators which can utilize wood waste of all sizes. The 'Doppelfeuer' process of gasification is described, and advice is given on the conversion of existing motors to producer gas and on the erection of producer-gas plant in wood-working factories. Generally it is more economical to use other types of fuel where stocks of refuse are very low; but where sufficient wood waste is available the introduction of producer-gas plant is strongly recommended.

33.38.2. DUPONT, G. **The gasification of wood and wood charcoal.** *Bull. Soc. Enc. Industr. nat., Paris* No. 141, 1942 (1–15). *Chem. Zbl.* I, 1943 (585). Chem. Abstr. 38 (3112–3). P.R.

Topics discussed include theories of gasification, the advantages and disadvantages of wood and wood charcoal as materials for gasification, water gas from wood

and wood charcoal, and the possibilities of using generator gas as fuel for motors, as industrial and domestic fuel. The best-known French gas generators are described.

33.39. Manufacture of Sugar, Oils, Alcohol, and Vinegar from Wood

33.39. PERLMAN, D. **Production of 2, 3-butylene glycol from wood hydrolyzates.** *Industr. Engng. Chem.* (*Industr. Ed.*) 36, 1944 (803–4). [Univ. of Wisconsin, Madison, Wis.] P.R.

Wood sugar solutions obtained by the Scholler process from Southern Yellow Pine, Southern Red Oak, Douglas Fir and White Spruce were fermented to 2, 3-butylene glycol by means of *Aerobacter aerogenes*, solutions in concentration up to about 17 per cent. having been completely fermented. About 35 per cent. of the fermented sugar is converted into 2, 3-butylene glycol, and a small amount of acetoin is also formed.

33.39 (67.1–2). SINGLY, R. DE. **A colonial industry of the future: wood hydrolysis.** *Carburants nat.* 4, 1943 (161–9). *Chem. Zbl.* II, 1943 (1679). Chem. Abstr. 38 (6077). P.R.

The history and scientific basis of wood hydrolysis are reviewed, and the processes of Meunier, Schöller, Bergius, Leone, Fouque, which are used in practice, are briefly described. The possibilities of producing alcohol in the colonies from hydrolyzed wood are treated in detail, and a specific plan for a plant using the Bergius process, with exact cost and profit data, is presented.

33.39. BERTHELOT, C. **The hydrolysis of cellulose materials. Present state and future prospects.** *Carburants nat.* 4, 1943 (112–4). *Chem. Zbl.* II, 1943 (1059). Chem. Abstr. 38 (6551). P.R.

A general discussion on the acid hydrolysis of cellulose. One metric ton of wood should yield theoretically 61·1 per cent. of sugar of the C_6 series (=395·1 l. of alcohol) or 83·3 per cent. of sugar of the C_6 and C_5 series (= 275 kg. of ketones). Practically 200–300 l. of EtOH is obtained. Hydrolysis of wood may be carried out to yield molasses for the feeding of cattle, yeast according to the Bergius process, alcohol, ketones, lignin as a by-product, acetic and formic acids, acetone and furfural. The chemistry of the hydrolysis of cellulose, the causes of poor yields and means of improving the yield (e.g. by hydrolysis with HCO_2H) are discussed.

33.39. COLLINS, C. **Wood hydrolysis to become a source of war alcohol.** *Chem. metall. Engng.* 51 (7), 1944 (100–1). [American Forest Products Industries, Inc., Washington, D.C.] L.S.

The author discusses briefly German methods of producing alcohol by acid hydrolysis of wood wastes and outlines some of the features of the American-improved process that will probably be used in a plant soon to be constructed in Oregon.

33.39. ROLLAND, M. **Production of by-products in carbonization of wood. Use of crude wood vinegar.** *Carburants nat.* 3, 1942 (223–7). *Chem. Zbl.* II, 1942 (2555). Chem. Abstr. 38, (3113). P.R.

The recovery of by-products of charcoal burning in small furnaces, especially crude wood vinegar, is discussed. The possibility of concentrating crude wood vinegar on the spot is assumed.

33.5. *Pitprops, Sleepers, Poles and Other Roughly Converted Wood*

33.51 : 12.25–8 (410) : 31.27. GREAT BRITAIN. **Ministry of Fuel and Power. Twenty-second annual report of the Safety in Mines Research Board 1943.** H.M. Stationery Office, London. 1944. pp. 30.

Tests have shown the average strengths of pitprops of European Larch grown in East Anglia and in Surrey to be equal at 2,690 lb. per sq. in., while those for Scots Pine were 2,280 and 1,720 lb. per sq. in. respectively. The props were unseasoned and stresses were computed on the mean cross-sectional area.

Tests of British-grown hardwood props showed that those of Ash and Oak are approximately of the same strength as the Baltic Pine props of the same dimensions provided that the bow does not exceed ½ in. per ft. of length and that the ends are cut reasonably square with the axes of the props; if the diameter of hardwood props is 1¼ times that of the equivalent Baltic Pine props, the amount of bow can be as much as ¾ in. per ft. length. Beech, Birch, Chestnut and Wych Elm are also satisfactory substitutes for Baltic Pine props of the same dimensions (pp. 18–9).

33.53 : 12.26–8. BRITISH HONDURAS. **Report of the Forest Department for the year ended 31st December, 1943.** Govt. Printer, Belize. 1944. pp. [8] + tables.

Tests have shown that Santa Maria (*Calophyllum antillanum*) can be used successfully in place of English Oak for dockyard work (p. 6).

33.53 : 31.27 : 12.25 : 33.36.1. LUMSDEN, G. Q. **New woods for crossarms and their preservation.** *Bell. Lab. Rec.* 22, 1944 (573–6).

Owing to the war-time scarcity of Douglas Fir and Southern Pine, tests have been carried out to determine the suitability of Red Pine, Jack Pine and the inland type of Douglas Fir for use as crossarms. The arms were given a non-pressure treatment with hot creosote followed by cold pentachlorophenol dissolved in a suitable petroleum. Retention of the preservative solution varied with the species and with the amount of sapwood present but was considered high enough to keep crossarms of all three species free from attack by wood-destroying fungi during their expected service life.

Breaking tests indicated that inland Fir is practically as strong as the standard coast-type Fir and Southern Pine arms at present in use. Red and Jack Pine, although only about 80 per cent. as strong, were generally considered strong enough for all line purposes except in extra long spans under heavy loading conditions.

33.6. *Packing Boxes, Crates, etc.*

33.6. LIMAYE, V. D. **The testing of ammunition boxes.** *Indian For. Rec.* (*n.s.*) *Utilization* 2 (9), 1942 (191–208 + plates).

Tests were made in order to find a satisfactory substitute for Burmese or Indian Teak in the manufacture of ammunition boxes. Kiln-seasoned Salai (*Boswellia serrata*) and Mango (*Mangifera indica*) are recommended for all types of ammunition box. Mango is slightly superior to Salai. The shrinkage and swelling of these timbers is practically equal to that of Teak, and boxes made from them are of superior strength.

33.6 (54) : 33.15. LIMAYE, V. D. **The testing of Indian**

plywood tea chests and suggestions for establishing a standard type. *Indian For. Rec.* (*n.s.*) *Utilization* 3 (4), 1943. pp. 10 + plates.

Nine different types of plywood tea chests were subjected to systematic tests with a view to establishing a standard tea chest of Indian make which is comparable with the best foreign makes. The results of these tests are described, and one of the types tested is recommended as standard. *Terminalia myriocarpa* was the main timber used.

33.6 : 12.26–8. NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

Experiments have shown that entirely satisfactory banana cases can be made from the Samoan timber Mamalava (*Planchonella samoensis*) (p. 21).

33.8. *Other manufactured Products*

33.8 (54) : 31.8. LIMAYE, V. D. **Helves and tool handles.** *Indian For.* 70, 1944 (175–7). [Forest Research Institute, Dehra Dun.]

Tool handles of Hickory and Ash were imported into India in large numbers before the war. Tests have shown that there are a number of Indian woods as good as Hickory and superior or equal to Ash as regards their strength properties. Millions of helves and other types of handles made of these woods have been supplied to the Armed Forces, the railways and other departments since the outbreak of war.

Lists are given of the timbers which have been found to be specially suited to various uses of this kind. Tool handles are often soaked in linseed oil or shaken in a drum with paraffin wax to give them a smooth finish and good polish and a certain amount of resistance to moisture changes.

33.8 : 33.15. **New wood material for picking sticks. Textile industry benefits.** *Mon. News Lett. Div. For. Prod. Aust.* No. 131, 1944 (2).

Before the war picking sticks used in Australian mills were made of American Hickory (*Carya* sp.). As this material is no longer imported, tests have been made to find a substitute. Australian timbers as such were found to be unsatisfactory, but improved woods of (1) resin-impregnated Coachwood (*Ceratopetalum apetalum*) veneers with a density of 62 lb./cu. ft., and (2) Spotted Gum (*Eucalyptus maculata*) veneers bonded with Tego film, having a density of 82 lb./cu. ft., gave an average life of 1,000 and 1,500 hours respectively, no splitting or mechanical failure occurring during periods of normal service.

33.8 : 12.26–8 (94). **Australian timbers for textile rollers.** *Mon. News Lett. Div. For. Prod. Aust.* No. 135, 1944 (5).

Before the war, textile rollers for Australian mills were made from American Rock Maple (*Acer saccharum*). As this material is no longer imported, tests have been made to find an Australian substitute: good results have been obtained with high density Silver Ash (*Flindersia* sp.), Saffronheart (*Halfordia drupifera*), Grey Box (*Eucalyptus hemiphloia*) and high density compregnated wood.

33.8 (68). STEPHENS, R. P. **Timber in the footwear industry. Recent developments in the Union.** *Off. J. Dep. Comm. Ind. S. Afr.* 5, 1943 (122–4, 128).

The two chief factors at present limiting the production of wooden heels in the Union of South Africa are (1) the availability of dry, suitable timber, and (2) the type of machinery used. The author is of the opinion that greater standardization in individual factories would increase efficiency of production. He also recommends the manufacture of the lower types of heels in preference to high heels, since woods of thinner dimensions can be dried more easily and quickly than thicker material and are more reliable after drying.

The most successful South African wood so far tested by the Forest Products Institute is wild Lemon (*Xymalos monospora*). It turns exceptionally well, is tough and takes nails well, but unfortunately it is difficult to season. Other indigenous woods which have been used and proved relatively satisfactory are White Wood (*Ilex capensis*), Cape Beech (*Rapanea melanophleos*), Wild Chestnut (*Calodendron capense*), Camdeboo Stinkwood (*Celtis kraussiana*), and White Pear (*Apodytes dimidiata*). Since these species season more easily and quickly than Lemon wood they are more suitable for the higher types of heels for which thicker timber is required. The most promising exotic tested is *Grevillea robusta*. Further experiments are being carried out with both indigenous and exotic woods. The suitability of certain imported species for heel manufacture is briefly indicated, and suggestions are given on the choice of timbers for use in the manufacture of clogs, shanks and rounder blocks.

33.9. *Grading and Storage of Converted Timber*

33.91 : 12.25–8 (94) : 31.8. AUSTRALIA. *Australian Standards* Nos. (E) 3D. 804–1944; (E) 3D. 803–1944; (E) 3D. 805–1944; (E) 2D. 806–1944; (E) 2D. 807–1944; (E) 2D. 808–1944; (E) 2D. 810–1944; (E) 2D. 811–1944. A.G.S.

The standards listed are for the species Queensland Maple (*Flindersia brayleyana*), Alpine Ash and Mountain Ash (*Eucalyptus gigantea* and *E. regnans*), Hoop Pine and Bunya Pine (*Araucaria cunninghamii* and *A. bidwilli*), Scented Satinwood (*Ceratopetalum apetalum*), King William Pine (*Athrotaxis selaginoides*), Bollywood (*Litsea reticulata*), Queensland Ash, Northern Silver Ash and Southern Silver Ash (*Flindersia bourjotiana*, *F. pubescens* and *F. schottiana*), Silver Silkwood (*F. acuminata*), and substitutes for Sitka Spruce (*Picea sitchensis*). The standards supersede the 1941 issues and provide for the classification of rough timber into recutting grades allowing otherwise prohibited defects which will be removed during conversion. Except for the omission of the details of the test procedure and the inclusion of a reference to the standard methods of test '(E) CD. 800–1944', the clauses covering timber quality remain essentially unchanged. In '(E) 2D. 808–1944' a kiln drying schedule has been added.

33.91 : 38.1. GREAT BRITAIN. **Wood blocks (interlocking) for floors.** *British Standard* No. B.S. 1187, 1944. pp. 13. A.G.S.

This covers hardwood and softwood side grain blocks laid on a rigid base. Minimum dimensions and grade descriptions are given together with a list of suitable flooring timbers arranged according to their abrasion resistance.

33.91 : 33.12 : 38.1. GREAT BRITAIN. **Grading of softwood joinery.** *British Standard* No. B.S. 1186, 1944. pp. 11. A.G.S.

This specification quotes the minimum quality and maximum permissible defects in timber for use in (1) external door and window frames, (2) internal door frames and non-structural members, (3) internal and external doors of framed and panelled construction. A list of suitable timbers is included.

33.91 : 31.22. **Sizes of stress-graded softwood timber.** *British Standard* No. B.S. 1175, 1944. pp. 9. British Standards Institution, 28, Victoria St., London, S.W.1.

This Standard relates only to dimensions of timber which have been graded in accordance with *British Standard* 940 (Pts. 1 and 2); 1940—'Grading Rules for Structural Timber'. The specification deals with sizes, shrinkage, and tolerances on dimensions. Appendix A gives a method for determining the moisture content of timber.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

34.24. Tanning Materials

34.24 : 12.25–8. FOWLER, M. E. **Prevent tanbark from spoiling.** U.S.D.A. Bureau of Plant Industry [Washington, D.C.] [1942]. pp. 2.

Many tanneries in the United States now use Chestnut-Oak and Hemlock bark in manufacturing leather. The bark-peeling season for these species is greatly influenced by rainfall, altitude and temperature. Chestnut-Oak bark can usually be peeled from the time just before the buds swell until the leaves reach mature size, while Hemlock can often be peeled throughout the summer months.

After peeling, the bark is spread out on brush or placed against a log until the free moisture has evaporated. After a few days, in favourable drying weather, it should be ready to pile. An open, dry site should be chosen and the bark pile raised off the ground on a base of small logs. The bark near the top of the pile should be carefully placed in shingle fashion and the top sloped, so that rain does not penetrate the pile. Piles are usually 3 or 4 ft. high and not more than 6 or 8 ft. long. Some operators leave the bark scattered in the woods, inner side down, for a month or 6 weeks before delivering it to the purchaser, and thus avoid the extra handling.

34.24 : 12.26–8. WOODHEAD, T. **A Sumac substitute from S.A. Wattle. Research yields remarkable results.** *Off. J. Dep. Comm. Ind., S. Afr.* 5, 1942 (25). [Leather Industries Research Institute, Rhodes Univ. College.]

Excellent results were obtained by treating leather with a mixture of 50 parts Wattle extract (solid), 50 parts sawdust, and 3 parts sodium hydrosulphite.

34.24 : 12.26–8 : 12.11.11. NECHAEV, V. K., TARANOVICH, N. M., SHAMKHEVICH, D., KARPMAN, M. J., and GUSEV, P. P. **Tanning materials.** *Legkaya Prom.* 1, 1941 (43–4). *Chem. Zbl.* I, 1943 (1849). Chem. Abstr. 38 (5687). P.R.

The barks of different Willows contain an average of 10·5 per cent. tannin. Of the types native to the Far East, *Salix viminalis, S. cinerea, S. filicifolia,* and *S. triandra amygdalina* yield technically applicable tanning material. The tannin content in various parts of Wild Chestnut is: wood, 8 per cent., bark 10 per cent., leaves (fresh-fallen) 12 per cent.; green husks, 8 per cent., and fresh male blossoms, 13 per cent.

34.24 : 12.25–8 (75). RUSSELL, A. with Associates. **Natural tanning materials of the southeastern United States.** *J. Amer. Leath. Chem. Ass.* 39, 1944 (173–8). L.S.

Sixty-six species of trees from 38 genera were collected from the Piedmont Section, an intermediate climatic zone between the coastal plain and the mountains. Thirty of these species did not contain significant amounts of tannin either in the wood or in the bark. Of the remainder, *Quercus phellos, Q. montana, Prunus americana* and *P. angustifolia* receive special mention. The bark of the two *Prunus* species produced excellent tanning materials, but unfortunately neither species is plentiful in the area. *Q. montana* has been used extensively as a minor source of extract, but supplies are rapidly being used up. *Q. phellos,* a species still fairly abundant, contains above 10 per cent. of tannin in its thick bark. The wood contains no significant amount of tannin, but since the species is large, with a main trunk often 5 ft. or more in diameter, it would be a valuable source of lumber.

34.25. Christmas Trees. Medicinal Plants. Edible Plants

34.25 (71.1) : 12.25 : 12.11.22. MILES, N. P. **Christmas tree trade thriving in interior British Columbia in spite of obstacles.** *B.C. Lumberm.* 28, 1944 (28–9).

Despite labour and transportation difficulties a total of more than one million Christmas trees were shipped from the East Kootenay District of British Columbia in the 1944 season. The trees which, owing to difficult growing conditions, would never produce lumber, are now generally farmed for Christmas-tree production on a sustained-yield basis—when the trees are cut, a stump and branch are left as the start of the next crop.

34.25 : 12.26–8 (54.87). JAYAWEERA, D. M. A. **History of Cinchona culture in Ceylon.** *Trop. Agriculturist, Ceylon* 99, 1943 (91–5 + graph). L.S.

In 1858 it was decided at a conference at Peradeniya to make trial plantings of *Cinchona* in Ceylon, and in 1861 the first seeds of *Cinchona micrantha, C. nitida, C. succirubra,* and *C. peruviana* were received on the Island. Numerous seeds or seedlings of these and other *Cinchona* species were later imported from time to time, and many thousands of plants were distributed to growers by the Hakgala and other nurseries, the most generally cultivated varieties being *C. succirubra* and *C. officinalis.* In 1880 an unparalleled impetus to the cultivation of *Cinchona* in Ceylon was given by the Government through the offer to planters of a certain amount of the more valuable *C. ledgeriana* stock, and by the year 1886 the export of *Cinchona* bark from the Island exceeded 15 million lb. From this time onwards, however, the export of bark began to decline, partly owing to low prices and partly owing to the low quality of the bark. Planters found it more profitable to plant tea instead of *Cinchona,* and by 1891 the cultivation of this crop in Ceylon was practically at an end.

34.25 : 12.26–8. WOKES, F., ORGAN, J. G., JAMES, E. M., and MELVILLE, R. **Apparent vitamin C as a possible precursor of true vitamin C in walnuts.** *Nature, Lond.* 154, 1944 (669–70).

Unripe walnuts have previously been reported to contain considerable amounts of apparent vitamin C, the provisional term suggested for substances which so

closely resemble true vitamin C that they may be confused with it when being estimated by the usual dye titration method, though they may be distinguished from it by modifications of Lugg's formaldehyde method. A detailed study has now been made of the relative proportions of true and apparent vitamin C in different tissues of the walnut throughout the period of growth and ripening.

The fruit in the earliest stages may contain practically no true vitamin C but very high concentrations (more than 1,000 mgm. per 100 gm.) of apparent vitamin C. The proportion of true vitamin C gradually increases until in the nearly ripe nut it approaches 100 per cent. Moreover, the apparent vitamin C also occurs in high concentrations in buds and leaves, and the concentration gradients suggest that a steady flow occurs from these centres of photosynthetic activity to the tissues of the nut, in which it may be converted into true vitamin C. Experiments made in 1944 have provided further evidence in favour of the hypothesis that apparent vitamin C may be a precursor of true vitamin C in walnuts, and research on the subject is continuing. There already seems to be evidence that, in walnuts at least, apparent vitamin C is not a mere degradation product, but rather a substance playing an important part in plant metabolism.

34.25 : 12.14.7 : 12.26–8. NESTLER, R. H., and BAILEY, W. W. **Sumac fruit as a food for bob-white quail.** *Amer. Midl. Nat.* 31, 1944 (689–96).

The fruit of Sumac (*Rhus* spp.) is generally considered excellent food for bob-white quail (*Colinus virginianus*), but experiments carried out recently by the Fish & Wildlife Service, U.S. Dept. of the Interior, in collaboration with the Bureau of Animal Industry, U.S. Dept. of Agriculture, conclusively showed that, though Sumac fruit is eaten by quail, it is insufficient, as a sole or primary article of diet, to maintain the birds through a critical period in winter.

34.26. Resin. Gums. Turpentine. Oils. Rubber. Latex. Dyestuffs. Sugar

34.26 : 12.25 (75.6–9 : 76). **Instruction for the use of chemical stimulants to increase gum naval stores production in 1943.** *Naval Stores Rev.* 52 (50), 1943 (8, 10, 12). [Southern Forest Exp. Sta.]

Two new and highly promising chemical treatments to stimulate gum yield from Pine were developed during 1942 by the Southern Forest Experiment Station: (1) Fortnightly chipping and treatment with a 40 per cent. solution of sulphuric acid; (2) weekly chipping and treatment with a 25 per cent. solution of caustic soda (lye). The chief advantage of (1) is that it extends the period of gum flow from a streak, and it is therefore recommended where there is a shortage of labour; treatment (2) does not extend the period of gum flow, but does greatly increase the rate of flow during the week following application. Solutions are most easily applied to the streak by means of a specially designed spray gun, which is made of acid- and alkali-resistant metals and plastics; but application with a brush or swab can be equally effective. Both treatments are suitable for average or good stands of Longleaf or Slash Pine. Detailed instructions for mixing and applying the solutions, and precautions for the safety of those using them, are given. Equipment is not yet available for safely applying solutions to pulling faces much above shoulder height.

34.26 : 12.25 (75.6–9 : 76). SNOW, A. G. **How to obtain increased yield of gum from virgin cupping.** *Naval Stores Rev.* 53 (46), 1944 (8, 10). [Southern Forest Exp. Sta.]

Tests were made to compare the yield of gum from first-year tapping of old-field Slash Pine (*Pinus caribaea*) by the following two methods:—(1) Gutters were inserted in broadaxe incisions after a moderate slabbing, the combined slabbing and incision resulting in a cut into the wood to a depth varying from ¾ in. to over 1¼ in. (2) Two streaks were cut about 3 in. apart; the maximum depth at the centre of each streak was ½ in. and they tapered at the shoulders and peak to just through the bark. The lower left-hand streak was slightly longer and about 1 in. lower at the peak than the lower right-hand one. The bark between the streaks was removed and gutters were tacked in.

Results showed that the second method gave an increase in yield, averaging 27 per cent. for the entire season, in comparison with the first method; this increase was greatest during the period immediately following tapping (50 per cent. increase for first month) and gradually declined towards the end of the season.

34.26 : 12.26–8 : 12.21. BOSE, S. R. **Agaru production by fungal inoculation in *Aquilaria agallocha* trees in Assam.** *Abstr.* in *Proc. 30th Indian Sci. Congr.* Part 3, 1943 (45).

Each year for three successive years (1939–41) a dozen mature trees of *Aquilaria agallocha* located in the Nambor Reserve of Assam were inoculated with pure culture of the fungus, *Cladosporium* sp. The first lot (1939), when examined in 1940 and 1941, showed successful production of 'Agaru' gum close to the inoculated areas. An abundance of fungal hyphae was noticed in sections of the wood and the 'Agaru' smell was detected in the distillate when the water containing infected pieces of wood was subjected to distillation with superheated steam.

34.26 : 12.26–8. SUKUMARAN KARTHA, A. R., and MENON, K. N. **The oil of *Mimusops elengi* (Linn.).** *Proc. Indian Acad. Sci.* 19, Sec. A (1), 1944 (1–4). L.S.

A report on the constants, acid composition and trisaturated glyceride content of the seed oil of *Mimusops elengi*, a tree of the natural order Sapotaceae indigenous to the Deccan peninsula.

34.26 (54) : 12.26–8. SASTRY, S. G. **Manufacture of Sandalwood oil in India.** *J. sci. industr. Res., India* 3, 1944 (75–8). I.H.

Distillation of Sandalwood oil from the heartwood of *Santalum album* has been carried on in India from very ancient times. Formerly the water distillation method was employed exclusively, but the method of low-pressure steam distillation has now been generally adopted. The factory at Mysore is the biggest and most completely equipped Sandalwood oil factory in the world, with an average output of about 120,000 lb. of oil per annum, the maximum capacity being 50 per cent. more. The output of all the other factories in India is about 40,000 to 50,000 lb. a year.

The process of steam distillation is described, and information is included on methods of packing, the composition of the oil, possible forms of adulteration, and past and present uses.

34.26 : 12.26–8. PENFOLD, A. R., and MORRISON, F. R. **Australian Eucalyptus oils 1939–1943. With notes on**

other Australian essential oils by E. S. Guenther. *Soap Perfum. Cosmet.* 17, 1944 (116–7). P.O.

After a short section on some of the uses of the principal constituents of *Eucalyptus* oils, the authors tabulate the various oil-yielding Eucalypts and gives brief notes on their location and yield and on the price and uses of the oils they produce.

Boronia concrete oil (from *Boronia megastigma*), Araucaria oil, and Huon Pine oil (from *Dacrydium franklinii*) are also briefly discussed.

34.26 : 12.26–8 (94). **Australian Tea tree oils.** *Bull. imp. Inst., Lond.* 42, 1944 (161–4). [Council for Scientific and Industrial Research, Australia.]

Analyses are given of the essential oils of three of the so-called Australian Tea Trees, *Melaleuca linariifolia*, *M. alternifolia* and *Leptospermum citratum*, together with some account of the habits of the trees and their commercial exploitation.

34.26 : 12.26–8. BOUTARIC, M. Das Lindensamenöl. [**Lime seed oil.**] *C.R. Acad. Agric. France* 29, 1943 (127–8). Chem. Zbl. II, 1943 (2221). D.S.I.R.

The oil is a dark yellowish brown, clear and still liquid at 0°. Its flavour resembles that of nut oil. From young trees of *Tilia sylvestris* 3–4 m. in height, roughly 5 kg. of fruit may be obtained, representing 1,840 g. of seeds from which 375 g. of oil may be extracted. Similar trees of *Tilia argentea* will produce about 2,375 g. of seed containing 585 g. of oil.

34.26 (44) : 12.26–8. BERGET, GUINIER, and PERROT. **The oil of the Beech.** *C.R. Acad. Agric. France* 29, 1943 (268–71). *Chem. Zbl.* II, 1943 (1063). Chem. Abstr. 38 (6582). P.R.

A discussion of the importance of Beech-nut oil for the French oil supply, questions of harvesting, and difficulties encountered in the production of the oil.

34.26 (81). KOPPEL, C. VAN DE. **Plant raw materials from Brazil and parallels with Surinam and the Dutch Indies. VId. Rosewood oil, Amazon turpentine, and other ethereal oils from the Amazon region.** *Ber. Afdeel. Handlsmus. K. Ver. Kolon. Inst.* No. 189, 1943. pp. 20. *Chem. Zbl.* II, 1943 (1678). Chem. Abstr. 38 (6495). P.R.

Data are given on the occurrence, production, economic importance and contamination of such products as well as on substitutes for them.

34.26 : 12.26–8 (727.1). AGUILAR, G., J.I. El hule y nuestra flora. [**Rubber and our flora.**] *Rev. agric., Guatemala* 20 (10/12), 1943 (19–33). [Span.] E.M.B.

The most important rubber-bearing species native to Guatemala are *Castilla elastica* and *C. gumifera* (*guatemalensis*), but there are many other shrubs and trees whose latex contains caoutchouc and which may be capable of producing economic amounts of rubber under cultivation although they offer little in the wild state. The author gives a key to these species and describes each briefly. They include species belonging to the genera *Castilloa*, *Artocarpus*, *Ficus*, *Rauwolfia*, *Stemmadenia*, *Tabernaemontana*, *Thevetia*, *Hippomane*, *Hura*, *Jatropha*, *Sapium*, *Tetrorchidium*, *Achras*, *Calocarpum*, *Chrysophyllum*, *Sideroxylon* and *Lucuma*.

34.26 : 12.26–8 : 12.19 : 23–4. VARINOIS, M. **Maple sugar.** *Génie civ.* 120, 1943 (186–7). *Chem. Zbl.* II, 1943 (1930). Chem. Abstr. 38 (6588–9). P.R.

The author discusses the occurrence, habitat and cultivation of Maple trees best suited for sugar production. An average tree produces yearly about 45 l. of sap containing 3 per cent. sugar.

34.26 : 12.26–8. FARMLOE, C. **Sources of London honey.** *Nature, Lond.* 155, 1945 (80–1).

Analysis shows that the bulk of the main honey flow from London (in particular the parks) is derived from the Limes (*Tilia europea*) and the Privet hedges (*Ligustrum vulgare*). In some years there is also a substantial honey-flow from Horse-Chestnut, Sycamore and Maple; but, coming early in the year, these nectars are mainly consumed in brood-rearing and not stored. Both Privet and *Ailanthus glandulosa*, which are much frequented by bees, give an unpleasant taint to honey. Pollen analysis of honey may reveal the district of origin of honey, but only chemical analysis reveals the source of the nectars, since all sorts of pollen get into the honey from flowers with very little nectar, whilst some nectar-bearing flowers, such as Lime, produce very little pollen. A honey produced in 1944 in Hertfordshire showed a pollen count of 81 per cent. Sweet Chestnut (*Castanea sativa*).

34.26 : 12.26–8. MELVILLE, R. ***Ailanthus*, source of peculiar London honey.** *Nature, Lond.* 154, 1944 (640–1). [Royal Botanic Gardens, Kew.]

Specimens of 1943 and 1944 honey from a Kensington apiary which had an unpleasant cat-like odour, were found to be derived from the flowers of *Ailanthus altissima*; the same effect is found in honey derived from Sweet Chestnut and Elder flowers. The substances responsible for this odour are presumably derived from certain constituents of the essential oils. Bearing this in mind, the 1943 honey was tested from time to time, and it was found that the unpleasant odour gradually faded and gave way to a muscatel odour of increasing intensity. It would apparently pay to store *Ailanthus*, *Castanea*, and possibly certain other honeys until the flavour matures.

34.27. Seeds. Fruits. Leaf Fodder. Fibres and Flosses

34.27 (54.8). WILSON, J. A. **Place of fodder from trees and shrubs in the agricultural and forestry economy of Madras.** *Indian For.* 70, 1944 (416–7).

In common with the rest of India, the cattle population of Madras is excessive, especially in dry areas and near reserved forests where cattle of low efficiency and little value can survive at little cost to their owners. While the agriculturist provides for his utility animals during the hot weather, he cannot afford to do so for his scrub animals, and from February onwards they have to depend on whatever cheap fodder is available. From March onwards, trees and shrubs put on new foliage, and it is only natural that this should be lopped for fodder. In the reserved forests lopping of trees is prohibited, except in the Guntur District, where the working plan has allowed for the removal of leaves of *Hardwickia binata* in times of fodder scarcity. In unreserved and waste lands, however, hot weather lopping is common and has ruined many thousands of acres. Details are given of the species most used. The usual view of forest officers is that as pasture management improves, the use of tree or shrub leaf fodder should cease.

Though no systematic study of composition and nutritive values exists, studies of a few species show tree leaves to be generally high in protein and lime, but

rather low in phosphorus. They have an energy value only equal to poor dry roughage such as straw, but are superior to straws in their content of digestible crude protein.

34.27 : 12.26–8 (54.2) : 45.11. DRUMMOND, R. O. **Lopping in the Kumaun Himalaya of United Provinces.** *Indian For.* 70, 1944 (401–8).

The article gives a short historical account of lopping in the (mainly Oak) forests of Kumaun, and the effects of varying governmental policies towards lopping. It contains an appreciation of the present position, the serious results of unrestricted lopping, and the dangers inherent in the practice unless carefully limited. The importance of *Kharaks* (steadings for cattle inside forests) as centres of lopping damage is stressed and desirable changes in the present policy are suggested.

34.27 : 12.14.5 : 12.25. Textilifibrer ur granbarr. **[Textile fibres from Spruce needles.]** *Skogen* 30, 1943 (231). [Sw.]

As a result of experiments which have been in progress for many years, German chemists have succeeded in producing synthetic raw materials from Spruce needles, chiefly textile fibres. This development is of importance as Spruce needles are available in unlimited quantities. R. P. J.

34.27 : 12.26–8 (94.3). FRANCIS, W. D. **Edible trees and shrubs. 3. Queensland Bottle Tree.** *Qd. agric. J.* 57, 1943 (349–50). L.S.

The tree characteristics and distribution of *Brachychiton rupestris* are noted briefly. The tree is limited to Queensland, where it is one of the best known and most valuable fodder trees. It is also commonly planted as a shade and ornamental tree.

34.6. *Utilization of Logging and Milling Waste*

34.6 : 33.3. TRAYER, G. W. **Successful forest industry must convert total wood crop into useful goods.** *B.C. Lumberm.* 28, 1944 (67–8, 70).

Proper utilization requires the development of new methods of conversion which will transform into useful goods all the wood crop, including sawdust and the wood at present left at the mills, in the woods and on the stump. Wood products fall into 3 main classes: (1) those in which wood is used more or less in its natural state, (2) those in which the properties of wood have been modified by various chemical or physical treatments ('improved woods') and (3) a group of chemically converted products or products of wood pyrolysis. Possible developments in the second and third classes are discussed, including impregnation processes, compression, paper laminates and, in greater detail, possible uses of lignin. It is finally emphasized that all these new and modified products of wood depend upon continuous, balanced production of the wood crop from managed forests, because cheap wood can only arise from basic wood-using industry, dependent on sustained-yield forests for its raw material. Very cheap and abundant wood can only come if such products as lumber, veneer and pulp bear the major part of the cost of raising trees.

34.6 : 33.32. NEWMAN, C. A. **Recovery of wood and fiber wastes.** *Pulp Paper Mag. Can.* 45, 1944 (603–4).

The recovery and utilization of all wood and fibre wastes at the Quebec North Shore Paper Company has been carried out for reasons of economy and wood conservation. The wood and fibre wastes, in the order of their magnitude, are groundwood secondary screen rejects, groundwood and sulphite knotter rejects, chip screen sawdust, sulphite primary screen rejects, a daily total of 25·3 tons, the equivalent of 19·2 cords of wood.

These rejects, with the exception of the sawdust, have been processed successfully at this mill, using a Jeffrey shredder and 2 Noblewood mills operating in series. The chip screen sawdust has been added to the wood chips and cooked in the digesters without affecting the quality of the sulphite pulp and with a fair return in respect of pulp yield. It has been necessary to compensate for the tendency towards coarser stock by producing a slightly finer grade at the grinders. The annual net savings at this mill, involved in the conversion of these rejects, is $70,361.

34.6 (71.1) : 33.7 : 76.2. **New field of revenue.** *W. Cst. Lumberm.* 71, 1944 (87, 89).

The Wood Fuel Control, in organizing the disposal of mill waste, has opened up a new field of revenue for sawmills and logging camps in British Columbia. The material is collected by the Control and distributed to the industries needing it as fuel. Emergency stocks have been built up in various localities. To assist the Control, legislation has restricted the burning of wood in sawdust and other burners at the mills, and has prohibited the logging of certain types of millwood.

34.6 : 33.7. ARIES, R. S. **Fuel briquets from wood waste.** *Timber of Canada* 5, 1944–45 (97–9, 102–3).

The author considers the advisability of large-scale production in Canada of fuel briquettes from waste wood. Favourable economic factors are the present shortage of transportation facilities for coal and oil, the increased price of coal on account of higher costs of mining, and the desirability of utilizing all waste products. On the other hand, an ample supply of wood must be assured, and the briquettes must be sold at a price less than three-quarters of that of bituminous coal, since the proportionate heat value is lower. The market should be in the immediate vicinity of the producing plant.

Methods of manufacture are outlined, and the equipment described. With high-pressure equipment a log more than three times as dense as wood is produced, occupying less space per ton than coal, though with only four-sevenths of the heat value. It is thought that briquettes would become a popular domestic fuel, with many advantages over coal, but that their commercial use would depend on the availability and price of coal in any particular area.

34.6 : 33.06. BROWNLIE, D. **Efficient burning of wood refuse.** *Pulp Paper Mag. Can.* 45, 1944 (446).

The article describes two water tube boilers recently installed in a factory in southern England to replace five coal and oil burning boilers. The new boilers burn only wood refuse and the saving in fuel costs is approximately £10,000 per annum. The method of stoking is described. The plant can be turned over to coal burning in an emergency.

34.6. BALDEN, F. E. **Waste wood fuel for steam production.** *W. Cst. Lumberm.* 71, 1944 (74).

A unit of waste wood fuel is defined, and its approximate chemical analysis given. It is calculated that the waste wood produced in one week in the States of Oregon and Washington would supply 560 million lb. of steam. Brief accounts are given of successive types

of boilers used for burning waste wood fuel since the installation of the first sawmills.

34.6 : 33.06. BOALS, R. B. **Northwest steam power development with relation to wood waste fuel.** *W. Cst. Lumberm.* 71, 1944 (68, 71–2, 75, 102).

An historical account of power-plant developments in the Northwestern States from 1850 to the present time.

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

38.1 : 31.27. RICHART, F. E., and WILLIAMS, C. B. **Tests of composite timber and concrete beams.** *Bull. Ill. Engng. Exp. Sta.* No. 343. 1943. pp. 62.

A detailed account is given of the objects, methods and results of strength tests made on composite timber-concrete beams, the tests being confined to beams of simple spans with one-third point loadings. The type of beam tested consists of a concrete slab placed on a continuous laminated deck made of small-dimensioned timbers placed on edge; it is intended primarily for floors subjected to heavy loads.

38.1. **Wood flooring.** Timber Development Association Ltd., 75, Cannon Street, London, E.C.4. 1944. pp. 37 + plates.

This illustrated booklet has as its object the giving of practical information to architects, contractors and others concerned with building work, on the desirable properties and qualities of wood flooring, and on various types of wood floors and paving, and concludes with a table of flooring timbers giving for each timber its common and botanical names, the highest traffic groups for which it should be used, its classification as to general resistance to wear, source of supply, general characteristics, and comments.

38.1. **The protection of split ring timber connectors against corrosion.** *Mon. News Lett. Div. For. Prod. Aust.* No. 133, 1944 (4).

From the results of tests covering a period of five years it is recommended that ring connectors to be used with green hardwoods in exposed conditions should be treated in a hot dip galvanizing with zinc at the rate of 2 oz. per sq. ft.

38.1–2. HANSEN, H. J. **Modern timber design.** John Wiley and Sons Inc., New York; Chapman and Hall Ltd., London. 1944. pp. v. + 230. Price 18*s.* net. A.G.S.

38.1–2 : 33.15 : 31.2. WHITTEMORE, H. L., PHELAN, V. B., and DILL, R. S., with the collaboration of LUXFORD, R. F. **Building materials and structures. Report BMS 99. Structural and heat-transfer properties of 'multiple box-girder plywood panels' for walls, floors, and roofs, sponsored by Loren H. Wittner.** National Bureau of Standards, U.S. Department of Commerce. 1943. pp. 11 + 25. P.O.

38.2. MEHRINGER, F. J., CARR, J. H., and DIETZ, A. G. H. **Spacing of split-ring timber connectors.** *Repr.* from *Engng. News Rec.* Oct. 7, 1943 (531–4).

To obtain data for use in calculating accurately the spacing of timber connectors, comprehensive loading tests were made, the loads being applied at angles ranging from 0° to 90° to the grain whiles the axes of the pairs of connectors varied from parallel to perpendicular to the grain to cover most conditions of design. The relevant data are given in charts and tables.

38.2 (931) : 33.91. NEW ZEALAND. **Light timber construction.** *New Zealand Standard Code of Building Bye Laws*, NZ. SS. 95. Pt. IX. A.G.S.

This bye-law relates to the type of construction known as 'Stud Framing'; it covers: (1) Timber quality, grades and seasoning; (2) nailing and fastening; and (3) the design of wall framing, floors, roofs and wall covering.

38.2 : 33.15. **Plywood-steel railway wagon.** *Wood* 10, 1945 (24).

Particulars, with diagram and photograph, of a new type of railway goods wagon constructed of plywood supported by a framework of steel and timber. These new wagons are said to be two tons lighter than the usual wagons of similar capacity.

38.2 (410). GREAT BRITAIN. **Panelled and glazed wood doors.** *British Standard* No. 459, Pt. 1. 1944. pp. 19.

38.2. KLOOT, N. H. **Tests on the holding power of Titan plain and processed cement-coated nails.** *Repr.* from *J. Coun. sci. industr. Res. Aust.* 17, 1944 (156–61).

Tests on holding power under static and impact loads indicate that the new processed cement-coated nail has an efficiency about 50 per cent. greater than the standard plain nail.

38.3. KREBS, E. Grundsätzliches zum Waldstrassenbau. **[Basic principles in the building of forest roads.]** *Schweiz. Z. Forstw.* 95, 1944 (312–9). [G.]

The author stresses the desirability of a co-ordinated network of forest roads and discusses such matters as the best average width, the maximum gradient, and the minimum radius of curve to be used in such roads.

4. FOREST INJURIES AND PROTECTION

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42 (71.4) : 12.25–8. POMERLEAU, R. Observations sur quelques maladies non parasitaires des arbres dans le Québec. **[Observations on some non-parasitic diseases of trees in Quebec.]** *Repr.* from *Canad. J. Res.* 22, Sec. C., 1944 (171–89). [F.]

The Director of the Bureau of Forest Pathology, Quebec, has here brought together notes on various non-parasitic diseases of trees observed in the Province of Quebec. Observations on certain diseases of internal origin are briefly reported; these include gall of *Betula papyrifera*, witches' broom of *Acer negundo*, burr of *Betula papyrifera* and *B. lutea*, discoloration of heartwood of Sugar Maple (*Acer saccharum*), fasciation of *Prunus pennsylvanica* f.

Of diseases due to external causes, the most important are those caused by cold. Some account is given of defoliation of conifers after an exceptionally severe winter, the effect of frost on the roots of Sugar Maple and *Fraxinus* spp. in wet soils, the production of lesions in *Abies balsamea* leading to decay of the sapwood, and frostcrack, cupshake and starshake, which affect all deciduous and most coniferous species. Damage from snow and rime frost are touched on, and a more detailed description given of the insolation of

ugar Maple, which causes wounds often leading to nker and fungal invasion.

Heat has fewer bad effects than cold in this region; e most important is the scorching of conifer seedlings the nursery.

Many diseases due to drought have been observed. ie most important, which is dealt with in some tail, is the die-back of *Betula papyrifera* and *B. lutea*; is occurs widely in the East of Canada and the nited States. These two species normally grow on a irly wet soil in the company of *Abies balsamea*, *Picea bra*, *P. glauca* and *Acer rubrum*. When the conifers e removed, the soil dries and becomes abnormally ated, and the Birch dies back. The drought of 1942 d 1943 produced the same effect on Birch growing in ncleared forest.

Other causes of disease such as excess of soil water, fertility of soil, and atmospheric impurities, are also scussed.

42.1. *Air Currents*

.1 (485) : 12.25 : 38.62 : 24.4. MOLDENHAWER, K. ormfällning i granskog. [**Storm felling in Spruce rest.**] *Skogsägaren* 19, 1943 (55–7). [Sw.]

Severe storms that occurred in Sweden in the late tumn of 1941 and in the latter part of the winter of 43 felled large areas of valuable forest. To increase e storm resistance of trees, careful drainage is neces- ry: this applies particularly to Spruce trees in Scania nich are more than 50 years old.

A shelterbelt at least 20 m. wide of some wind- sistant species should be established on the windward le of pure Spruce plantations on exposed sites.

R. P. J.

42.2. *Temperature Influences*

.21 (43.1–5) : 12.26–8. KRAHL-URBAN. Winterfrost- häden an Eichen. [**Winter frost damage to Oaks.**] *Forst- u. Jagdw.* 75, 1943 (78–91). [G.]

A review of frost damage to one-year-old Oak plants many parts of Germany, particularly during the nter of 1941–42. Investigations carried out at the ginning of June 1942 revealed that the above-ground rts of the seedlings were undamaged and that death emed to have resulted from the destruction of the rk and cambium at the root collar and the upper 7 cm. of the root. Details are given of observations ade on various sites. The damage appears to have en due mainly to lack of sufficient lignification in the ar-old plants (older seedlings escaped injury)—a ndition possibly brought about by unfavourable eather conditions earlier in the year. Losses of Oak edlings varied with the direction of exposure and the lation of the plants to the shelter provided by neigh- uring stands or other vegetation. The author iefly reviews the most important environmental ctors and their influence (if any) on the degree of frost jury.

.21 : 12.26–8. DENGLER, A. Frostschäden an Stiel- nd Traubeneichen. [**Frost damage to *Quercus robur* nd *Q. sessiliflora*.**] *Z. ges. Forstw.* 76 [70], 1944 55–8). [G.]

From observations on the effect of late frosts on ung plants of *Quercus robur* and *Q. sessiliflora* the uthor suggests that the frost hardiness of either ecies may be conditioned by the stage of development ached by the opening leaves when the frost occurs. the young trees studied by the author frost damage was most severe in the case of *Q. sessiliflora*. This contradicts the view generally expressed that *Q. robur* is the more frost-susceptible species.

42.21 (485). Skador å våra skogsträd förorsakade av de båda sensaste årens stränga klimat. [**Injuries to Sweden's forest trees caused by the severe climatic conditions of the last two winters.**] *Skogs garen* 19, 1943 (62–4). [Sw.]

The most obvious adverse effects of climate on forest trees are die-back and short annual shoots. The latter is characteristic, at least of Spruce, in the greater part of Sweden. Probably this reduced growth is only indirectly caused by cold, and is due far more to the considerably shortened vegetative period resulting from the long winter, and also, in 1941, to the unusually dry and warm summer.

Die-back is seen everywhere, mainly in young stands; the withered portion in the majority of cases extends about 2–3 m. down the trunk. There are various theories as to the cause of this injury—fungus attack, gnawing by squirrels, etc., but it is probably due to the climate. Injury to Silver Spruce has in certain regions been catastrophic.

In Scania the Beech has been found to be affected by so-called 'frost-core' as a result of the severe winter of 1941–42. This injury impairs the quality of the timber considerably and renders it unfit for use in parquet work.

'Frost burn' occurs in stands growing on marshy land, and fens; the trees in such situations break dormancy while the roots are still unable to absorb water and nutrients, because of the frozen soil. If this condition persists for a long period, the tree withers completely. The timber of trees killed in this way becomes dark in colour and can be used only for fuel.

R. P. J.

42.5. *Chemical Influences. Nutrient Deficiencies*

42.5 : 12.25 (94). AUSTRALIA. **Annual report of the Commonwealth Forestry Bureau for year 1943.** Commonwealth Govt. Printer, Canberra. 1944. pp. 12.

One of the most serious disorders of Monterey Pine (*Pinus radiata*) in southeastern Australia is known as 'spindle growth' and affects whole blocks of forest. The application of zinc in solid form has improved the health of leading shoots but has not resulted in increased growth. Spraying with commercial zinc has had a marked effect in controlling 'die-back'; zinc in solid form will not act quickly enough to prevent this disorder, but does result in increased growth and will eventually improve the health of the tree (p. 5).

43. FOREST FIRES

43.1. *Protective Measures*

43.1 (410). CONNELL, C. A. **Some recent improvements in forest fire organization and fighting.** *Forestry* 18, 1944 (21–7).

The mechanization of forest fire fighting in Great Britain has necessitated improvements in accessibility to all areas of the forest. It is found desirable to break down woodlands by major and minor ride systems into blocks of about 5 acres. The rides in difficult terrain are formed by bulldozers and graders. Additional access is provided by the brashing of plantations. The use of water has been successfully added to the conventional beating technique for combating forest fires.

Economical use of limited water supplies is ensured by low-consumption high-pressure light-weight pumps.

43.11 : 43.0. HAYES, G. L. **Where and when to measure forest-fire danger.** *J. For.* 42, 1944 (744–51).

The results of a study by the Northern Rocky Mountain Forest and Range Experiment Station, to determine the place, time and number of measurements that should be made to obtain reliable estimates of 'average-bad' fire conditions, without making use of an excessive number of stations or observations. The author concludes that, under the conditions prevailing in the Priest River Experimental Forest in northern Idaho, a single measurement taken daily at noon at either a valley-bottom or a south-slope station is adequate for the estimating of fire danger.

43.12–3 : 07.7. PRYOR, L. D., and SHOOBRIDGE, D. W. **Radio telephone and fire control.** *Aust. For.* 8, 1944 (4–12).

An account of the use of radio telephone in fire control in the Australian Capital Territory, with a description of the radio equipment and figures of performance. Advantages and disadvantages of the system, compared with ordinary telephone, are enumerated.

43.3. *Fire Damage*

43.3 (945) : 32.25 : 32.82 : 33.36.1. BOND, D. W. **Timber salvage in Victoria.** *Aust. For.* 8, 1944 (13–9).

As a result of disastrous fires in January 1939 in the mountain forests of Central and Eastern Victoria, a very large amount of timber (estimated at 2,070 million super. ft. H.L.V.) was killed, and in addition a large amount was damaged. The Forests Commission worked out a plan for salvage and the State Government allotted £475,000 for the purpose. The inaccessible nature of much of the area necessitated a large road-building plan, and the scheme as a whole has been slowed down by bad weather and war conditions. Nevertheless, up to 1943 a total of some 582,586,000 super. ft. of timber had been salved, and it is hoped that by July 1945 the work will be complete. Sawmills established in the burnt areas have been able to deal with about one-third of the salvageable timber, while the rest has been felled and dumped. The application of creolatum (mixed crude petroleum and creosote in equal proportions) to the ends of felled logs proved effective for 2 years against insect attack. Sprays with an 18-ft. rotary arm have proved to be the most practicable method for protecting dumps; they keep the logs thoroughly wet on a comparatively small water consumption, and eventually a coating of slime forms on exposed log surfaces, which further assists in keeping the logs saturated. Under these conditions no new cracking occurs, insect attack is inhibited, or stopped if it has commenced before spraying, and fire risk is very much reduced.

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

44.3. *Fungi*

44.3 : 12.26–8 : 12.21. ZENTMYER, G. A., WALLACE, P. P., and HORSFALL, J. G. **Distance as a dosage factor in the spread of Dutch Elm disease.** *Phytopathology* 34, 1944 (1025–33).

The spread of Dutch Elm disease was analysed statistically from data obtained from 3 plots, each having a single naturally diseased Elm at the centre as source of inoculum, with a distribution of healthy Elms in the vicinity approaching randomness. The disease fungus (*Ceratostomella ulmi*) is spread primarily by the European Elm bark beetle (*Scolytus multistriatus*). Adults of the beetle were seen emerging from the three infected Elms in the summer of 1941, and data collected in August and September 1942, gave the following results:—

(1) The proportion of infected trees on the plots decreased with the distance from the source of inoculum. Intensification of the disease in the immediate vicinity of the original infections was very marked; 75 per cent. of the new infections appeared within 100 ft. of the original diseased trees, and 40 per cent. of the trees within 75 ft. of the plot centres became diseased.

(2) The distance of dissemination of the fungus to the north of the plot centres was approximately twice that to the south. Prevailing south winds during the beetle emergence apparently caused this divergence.

44.3 : 12.26–8 : 12.21. KENEALY, J. C. **The Dutch Elm disease.** *For. Leaves* 34, 1944 (1, 8).

The war-time cessation of research and field work in the control of Dutch Elm disease may cause an epidemic of the disease in Pennsylvania, unless Elm trees can be protected from attack by bark beetles which carry the disease. The article points out that if trees are kept in a healthy condition they are less liable to beetle attack, and instructions are given for achieving this object. Owners are advised to destroy all dead and dying Elms, to prune out dead and weak branches, and to apply to the trees a fertiliser rich in nitrogen.

44.3 : 12.25 : 12.26–8 : 12.21. KIMMEY, J. W., and MIELKE, J. L. **Susceptibility to White Pine blister rust of *Ribes cereum* and some other *Ribes* associated with Sugar Pine in California.** *J. For.* 42, 1944 (752–6).

In the control of *Cronartium ribicola*, it is of basic importance to know the potential Pine-infecting capacity of the various species of *Ribes* which occur in association with the Pines to be protected. The study here reported was conducted to determine this for certain control units in Sugar Pine (*Pinus lambertiana*) stands of the California Sierras. A tentative susceptibility rating is given for the species of *Ribes* tested.

44.3 : 12.25 : 12.21. **Blister rust eradication.** *Timberman* 46, 1944–45 (22–5).

Considerable progress has been made towards controlling the White Pine blister rust (*Cronartium ribicola*) in the northwestern States; to complete this work a six-year post-war programme is advocated, the success of which would be based on the removal of *Ribes* spp. from all areas known to have been infected. It would provide employment for 4,000 men and permanently protect some 2,600,000 acres of forest land.

44.3 : 12.25 : 12.21 : 23.6. BALTHIS, R. F., and ANDERSON, D. A. **Effect of cultivation in a young Slash Pine plantation on the development of *Cronartium* cankers and forked trees.** *J. For.* 42, 1944 (926–7). [Texas Forest Service.]

In January 1940 a study was undertaken in Newton County, Texas, to determine the effect of cultivation in a Slash Pine plantation. Two adjacent, 1-acre plots of similar character were planted with similar stock; in one plot seedlings were planted in the rough, in hoed spots, and received no further treatment; the second plot was clean-cultivated before planting and thereafter cultivated at intervals to keep down grass and weeds. At the end of a 4-year growth period, the cultivated trees

excelled in survival, height and diameter. They also included a greater total number of forked trees and of trees infected by *Cronartium* rust cankers. The greatest number of limb cankers occurred at a height of 2 ft. above the ground and the majority of cankers are found from ground level to this height. The highest point of infection on the cultivated plot was 7½ ft. compared with 4½ ft. on the uncultivated plot. The reason for forking, except for excessive growth, is unknown. The higher percentage of trees infected by *Cronartium* in the cultivated plot is attributed to the difference in rate of growth on the two plots, the cultivated trees probably producing succulent, rust-susceptible tissue for longer periods than the uncultivated trees.

44.3 : 12.25 : 12.26–8 : 12.21. STILLINGER, C. R. **Notes on *Cronartium occidentale*.** *Northw. Sci.* 18, 1944 (11–6). R.A.M. 23, 1944 (464).

Cronartium occidentale was observed for the first time in nature during the summers of 1919 to 1921 on *Ribes lasianthum, R. hesperium, R. parishi, R. roezli, R. speciosum, R. cereum, R. indecorum, R. malvaceum, R. nevadense,* and *R. montigenum* in Wyoming. The collections on *R. inerme* in California, *R. aureum* in Montana and Nevada, and *R. odoratum* in Idaho are the first in these States on the host in question, while the presence of the rust in Montana and Nebraska has not previously been reported. The apparent spread of *C. occidentale* from Piñon Pines (*Pinus edulis* and *P. monophylla*) to *Ribes* for a distance of 650 miles from known foci of infection and 425 miles beyond the ascertained range of the hosts is recorded, these observations having been made at Spokane, Washington, in 1912 and 1914. The rust was shown to be capable of overwintering on living *Ribes* leaves at Monrovia and Los Angeles, California (1920) and Denver, Colorado (1922). In view of the similarity between *C. occidentale* and *C. ribicola*, the agent of White Pine blister rust, it is thought not unlikely that the latter may also be conveyed over much longer distances than have hitherto been established for this species.

44.3 : 12.26–8 : 12.21. HEPTING, G. H. **Sapstreak, a new killing disease of Sugar Maple.** *Phytopathology* 34, 1944 (1069–76).

A disease of Sugar Maple, for which the name 'sapstreak' is proposed, has been killing large numbers of trees in a part of the Pisgah National Forest, near Asheville, N.C. Healthy sapwood of vigorous trees is invaded by a strain of the fungus *Endoconidiophora virescens,* which produces gray to reddish radial streaks and watersoaked areas in the wood. The foliage becomes progressively smaller and paler green each year, and death usually occurs within 2 to 4 years from the first evidence of crown-thinning. Inoculation of 12 large trees with *E. virescens* resulted in 2 dying and 4 becoming heavily diseased, in 3 years.

The causal fungus is morphologically indistinguishable from the common sapstain fungus on hardwood lumber, earlier referred to as *E. coerulescens* and recently renamed *E. virescens. Author's summary.*

44.3 : 12.26–8 : 12.21. FOWLER, M. E., and STEVENSON, J. A. **A canker and some decay fungi on Mimosa.** *Phytopathology* 34, 1944 (985–7). [Plant Industry Station, Beltsville, Maryland.]

A recent examination of Mimosa trees (*Albizzia julibrissin*) in the District of Columbia disclosed numerous cankers which were found to be caused by *Nectria cinnabarina* Fr., for the most part in its imperfect stage (*Tuberculoria vulgaris* Fr.); in each case the canker had developed round the base of a small dead twig, indicating that the causal organism may be able to attack healthy wood only when it has been previously established in an adjoining dead portion. Only two occurrences of this fungus on *Albizzia* seem to have been previously published, one in N. Carolina and the other in Virginia.

Although the *Nectria* was the predominant fungus noted, other fungi were present on dead and dying branches and were doubtless contributing to the decline of the host trees. Five species in particular were wood-decaying fungi: *Polyporus versicolor* Fr., *P. hirsutus* Fr., *P. tulipiferus* (Schw.) Overh., *Stereum albobadium* (Schw.) Fr., and *Schizophyllum commune* Fr. *Eutypella stellulata* (Fr.) Sacc. was also present in abundance on dead twigs and branches. All are common on other woody hosts, but do not appear to have been reported previously on *Albizzia.*

44.3 : 12.26–8 : 12.21. ARK, P. A. **Further evidence of pollen dissemination of Walnut blight.** *Abstr.* in *Phytopathology* 34, 1944 (933).

In the spring of 1944, many recently pollinated nuts (3 to 5 mm. in size) in a commercial walnut orchard were completely blighted by *Phytomonas juglandis.* No foliar blight and hold-over lesions occurred on the majority of trees examined. This condition prevailed on both Bordeaux-sprayed and unsprayed trees. Wash water from apparently healthy leaves and nuts from trees in the blighted orchard yielded virulent cultures of *P. juglandis.* Young Northern California Black Walnut trees, although planted 25 to 50 ft. from blighted Payne trees, had numerous leaf infections from the tree top to the ground line. However, no cankers or blighted dormant buds could be detected on these trees. In absence of hold-over lesions, it is assumed that the disease was induced by walnut pollen grains abundantly present on the leaves. Since many nuts are initially blighted at the apical end, and some well-separated, young, non-bearing trees develop foliar blight in the absence of overwintering foci of infection, it is believed that the present high incidence of the disease may be attributed to contaminated wind-borne walnut pollen, originating in partially blighted catkins of the highly susceptible Payne variety.

44.3 : 12.26–8 : 12.21. RIVERA, V. **Observations on *Phytophthora cambivora*, causal agent of the Chestnut ink disease.** *Int. Bull. Pl. Prot.* 17 (4), 1943 (49M–56M). R.A.M. 23, 1944 (156–7).

Cultural studies on *Phytophthora cambivora*, the cause of Chestnut ink disease on sterilized wood of Chestnut and other trees, showed that some woods are compatible with the development of the mycelium of the fungus, particularly evaporated Beech, Beech and Poplar, whereas on others the mycelium will develop only if some specially suitable substance, such as malt, is added; such addition, however, does not induce development on Chestnut, though by prolonged culture on Chestnut sawdust and malt at 22° C. or more, a restricted growth of mycelium can be induced.

Not only has the wood of the plant most susceptible to the disease an almost inhibitive effect on the mycelium, such as is not possessed by woods of resistant plants, but the tannic compound produced in the

Chestnut wood in the presence of the fungus prevents any pronounced development of mycelium. This interpretation is supported by the fact that whenever appreciable growth occurred on Chestnut sawdust with malt, 'ink' production occurred simultaneously with fungal development, while no 'ink' was produced when the mycelium failed to reach a certain degree of development. It is considered that ink production is a defensive reaction, though not usually an effective one.

In contrast with the wood, the cambium of the Chestnut constitutes a highly favourable living medium for the growth of *P. cambivora*.

Other experiments demonstrated that the mycelium was devitalized by exposure to a temperature of 56° for 30 minutes or of 41° to 42° for 74 minutes, while growth was stimulated by exposure to the same temperatures for 20 and 60 minutes respectively.

44.3 : 12.26–8 : 12.21. Laboratio de Cryptogamia. *Ex* Memoria Estación de Fitopatología Agrícola de la Coruña, 1942. [**Cryptogamic Laboratory, *Ex* Report of the Corunna Station of Agricultural Phytopathology, 1942.**] *Publ. Estac. Fitopat. agric. Coruña* 23, 1943 (21–57). [Span.] R.A.M. 23 (375–7).

Includes results from further studies on Chestnut ink disease (*Phytophthora cambivora*). Some of these data suggest the existence within *P. cambivora* of multiple varieties or forms which are not, however, specifically related to any particular host.

44.3 : 12.26–8 : 12.21 : 23.27. WALTER, J. M. **Wound dressing for London Plane trees.** *Plant Dis. Reptr.* 28, 1944 (356). R.A.M. 24, 1945 (39).

The fungus responsible for canker stain of London Plane (*Platanus acerifolia*) trees, a species of *Endoconidiophora* very closely related to *E.* (*Ceratostomella*) *fimbriata*, may survive for several days in the commonly used brands of asphalt tree wound paints contaminated by infected sawdust, fragments of bark and wood, or spores of the organism. In experiments in New Jersey, this prevalent cause of spread of the pathogen was obviated by the thorough admixture with wound dressings of the gilsonite varnish types only, of 0·2 per cent. phenyl mercury nitrate. No infections resulted from inoculations with contaminated paint treated in this way, whereas the same material without the disinfectant chemical caused 90 to 100 per cent. infection.

44.3 : 12.26–8 : 12.21. **Plant diseases. Notes contributed by the Biological Branch.** *Agric. Gaz. N.S.W.* 55, 1944 (235–9). R.A.M. 23, 1944 (429–30).

New records for the six months ending 30th April, 1944, include *Bacterium* (*Pseudomonas*) *syringae* on Golden Poplar.

44.3 : 12.25 (42.1–8) : 12.21. PEACE, T. R. **The occurrence of *Melampsora pinitorqua* on Scots Pine in south-eastern England.** *Forestry* 18, 1944 (47–8).

Between 1942 and 1944 the fungus *Melampsora pinitorqua* was found doing appreciable damage to young Scots Pine over limited areas in four places in Kent and Sussex. The alternate host, *Populus tremula*, was abundant in all the infested plantations.

44.3 (45) : 12.26–8 : 12.21. **Discoveries and current events. Italy. Plant pathology notes.** *Int. Bull. Pl. Prot.* 17 (1), 1943 (1M–2M). R.A.M. 23, 1944 (128).

The conidial stage (*Gloeosporium*) of *Physalospora miyabeana*, new to Italy, was found on *Salix babylonica* at Busalla, Genoa.

44.3 : 12.26–8 : 12.21. JENKINS, A. E. **A recent account of anthracnose of Poplar in Italy.** *Rev. argent. Agron.* 11, 1944 (103–5 + plate). R.A.M. 23, 1944 (462).

In connexion with recent studies on Poplar anthracnose (*Sphaceloma populi*) in South America, attention is drawn to Servazzi's record in 1934 of leaf-withering in Italy, where the pathogen was designated by Saccardo's name of *Hadrotrichum populi*.

44.3 (46) : 12.26–8 : 12.21. MARTÍNEZ, J. B., and DEL CANIZO, J. **Spain. Forest pathology notes.** *Int. Bull. Pl. Prot.* 16 (10), 1942 (133M). R.A.M. 23, 1944 (155).

During the first six months of 1942, the following were among the important investigations carried out at the Forestry Institute, Madrid. Poplar (*Populus nigra* var. *fastigiata*) groves consisting of five- to seven-year-old trees in the Burgos Province suffered from a die-back of the branches caused by *Dothiorella populnea*, not hitherto recorded from Spain. The mycelium develops in the living bark, and the stromata are fairly common in branches 1 cm. or less in diameter, in association with the saprophyte *Coniothecium radians*, the mycelium of which occupies the rhytidome.

Beeches in the Navarra Provinces were infected by *Hypoxylon coccineum*, *Bispora monilioides*, and *Schizophyllum commune*, the trouble being due to the impracticability of prompt clearance of the cut and decorticated logs, which have to remain for considerable periods on the ground in the forests. As a preventive, application of 15 per cent. zinc chloride to exposed parts on the timber is being made.

44.3 (54) : 12.26–8 : 12.21. PADWICK, G. W., and MERH, J. L. **Notes on Indian fungi. I.** *Mycol. Pap. imp. mycol. Inst.* 7, 1943. pp. 7. R.A.M. 23, 1944 (151).

This series gives information on miscellaneous fungi noted at the Imperial Agricultural Research Institute, New Delhi, which it is not immediately convenient to include in the groups undergoing critical taxonomic investigations. The present annotated list comprises 13 species collected between 1939 and 1941. *Sphaerotheca lanestris* was found for the first time in India, on *Quercus incana* (a new host) at Mussoorie, United Provinces. The dense, brownish-white mycelial felt covering the young leaves causes thickening, brittleness, and stunting.

44.3 (56.9) : 12.26–8 : 12.21. MINZ, G. **Bees gather rust spores of *Melampsora populina* Kleb.** *Hassadeh* 22 (6), 1942 (173). [Heb.] R.A.M. 23 (366).

Leaf rust (*Melampsora* [*larici-*] *populina*) on Poplar (*Populus nigra*) usually occurs in Palestine from October to November, but sometimes earlier. The rust pustules protrude from the leaf and are filled with yellow spores resembling pollen: when the rust appears, the bees come in large numbers to gather the spores. The use made by the bees of the spores is not known.

44.3 : 12.26–8 : 12.21 (73). JENKINS, A. E. **Two new records of *Sphaceloma* diseases in the United States.** *Phytopathology* 34, 1944 (981–3).

Sphaceloma araliae has been identified on plants in north-eastern Missouri; this fungus was previously reported only from Maryland.

Diseased Willow leaves gathered in Skagit County, Washington, have been recognized to be affected by grey scab caused by *Sphaceloma murrayae* Jenkins and Grodsinsky. The hosts and geographic range of *S. murrayae* as previously known may be summarized as

follows:—*Salix babylonica* L., New Zealand; *S. fragilis* L., Rhode Island, Virginia, and New Zealand; *S. fragilis* × *alba*, Virginia; *S. lasiolepis* Benth., California; *S. viminalis* L., Latvia, and on this species as cultivated in the Delta del Paraná, Argentina. Nearly all the collection localities are coastal, and all are within the reach of ocean influence. It may well be that this fungus occurs still more widely than is yet known, both as to host species and as to geographic range.

44.3 (75.9) : 12.25–8 : 12.21. MURRILL, W. A. **Fungous diseases of Florida forest trees.** *Plant Dis. Reptr.* 28 (3), 1944 (103–12). R.A.M. 23 (415).

This list of fungous diseases of wild native trees in Florida is arranged under four headings: leaf diseases, trunk and branch diseases, root diseases, and rust diseases. Each group is introduced by a short general note, and the fungi listed alphabetically with the common name of the host, an index of scientific names of the hosts being appended.

44.3 (75.9) : 12.25–8 : 12.21. RHOADS, A. S. **Further notes on *Clitocybe* root rot of woody plants in Florida.** *Plant Dis. Reptr.* 27 (24), 1943 (694–6). R.A.M. 23, 1944 (417).

Further records of root rot due to *Clitocybe tabescens* in Florida include, among others, *Casuarina cunninghamiana* and Laurel Oak (*Quercus laurifolia*).

44.3 (82) : 12.26–8 : 12.21. SARASOLA, A. A. Dos septoriosis de las Alamedas argentinas. **[Two septorioses of Argentine Poplar groves.]** *Rev. argent. Agron.* 11, 1944 (20–43). [Span.] R.A.M. 23 (365–6).

A comprehensive account is given of the author's studies on two diseases affecting Poplars in Argentina, namely, the canker caused by *Septoria musiva* and the leaf spot due to *S. populi*. Cultural studies on both fungi were made on various standard media, of which rolled oats and cherry agars proved to be the most suitable. The formation of germinable chlamydospores in culture raises the question of their probable occurrence under natural conditions.

The possibilities of control, notably by the cultivation of resistant varieties, are under consideration.

44.3 (82) : 12.26–8 : 12.21. JAUCH, C. La presencia de '*Cylindrocladium scoparium*' en la Argentina. **[The presence of *Cylindrocladium scoparium* in Argentina.]** *Rev. argent. Agron.* 10, 1943 (355–60 + plates). [Span.e.] R.A.M. 23, 1944 (135).

Cylindrocladium scoparium has recently been observed to attack apricots, yerba-mate, *Eucalyptus* and roses in various parts of Argentina. *Eucalyptus* seedlings are invaded through the collar, which is girdled and rotted by the dark-coloured lesions of the pathogen. The following species of *Eucalyptus* were infected: *E. globulis*, *E. rostrata*, *E. viminalis*, *E. resinosa*, and *E. cinerea*. In cross-inoculation tests the strains from the various hosts were mutually pathogenic.

44.3 : 12.25 : 12.26–8 : 12.21. NEW ZEALAND. **State Forest Service. Annual report of the Director of Forestry for the year ended 31st March, 1944.** Govt. Printer, Wellington. 1944. pp. 38.

Examination of exotic conifers planted in worked Podocarp forest in 1929 showed the following species to be susceptible to the common shoe-string fungus (*Armillaria mellea*) in the order shown, mortality being particularly high in the first three species: *Pinus strobus*, *P. muricata*, *Cupressus lawsoniana*, *Pinus ponderosa*, *P. laricio*, and *P. murrayana*. *Pseudotsuga taxifolia* was not attacked (p. 7). *Thuja plicata* and *Eucalyptus regnans* are also recorded as hosts of this fungus (p. 10).

44.4. *Virus Diseases*

44.4 : 12.26–8. BRIERLEY, P. **Viruses described primarily on ornamental or miscellaneous hosts.** *Plant Dis. Reptr. Suppl.* No. 150, 1944 (410–82). R.A.M. 23, 1944 (438–9).

The following viruses are included among the 74 viruses listed in alphabetical order according to the generic names of their principal hosts, with notes on their synonymy, common names, geographical distribution, host range, mode of transmission, properties, other pertinent observations, and the relevant literature, as part of a project of the Committee on Virus Classification and Nomenclature of the American Phytopathological Society dealing with the codification of published information on these subjects: *Acer* (Maple) variegation, Elder mosaic, Elm mosaic, Elm phloem necrosis, *Euonymus* variegation, Horse Chestnut variegation, *Ilex* variegation, *Laburnum* variegation, *Prunus* rough bark, *Rhamnus* variegation, *Robinia* brooming, *Sorbus* variegation, and *Tabebuia* witches' broom.

45. DAMAGE BY ANIMALS

45.1. *Mammals*

45.12 : 12.25–8 : 13.2. SWEETMAN, H. L. **Selection of woody plants as winter food by the cottontail rabbit.** *Ecology* 25, 1944 (467–72).

The winter food choices from 100 available species of woody plants on a 3-acre site are analysed for relative attractiveness as food of the cottontail rabbit, *Sylvilagus floridanus mallurus*. Attractiveness was based on the amount of feeding injury suffered by the plants. The Salicaceae, represented by 8 species, and *Morus alba* did not appear to be very attractive, though most plants were slightly injured. The following were seriously injured: *Ulmus americana*, *Hamamelis virginiana*, *Ilex verticillata*, *Celastrus scandens*, *Koelreuteria paniculata*, *Artemisia abrotanum*, *Sassafras officinale*, *Acer rubrum*, *A. saccharum*, the Fagaceae (5 species), *Sorbus americana*, *Prunus serotina*, *Cornus candidissima*, *C. florida*, *Corylus americana*, *Betula lenta*, *B. populifolia*, *Rhus typhina*, *Pinus resinosa*, *P. strobus*, and *Picea abies*.

45.12 : 13.2. **Protecting trees from rabbits.** *Amer. Nurserym.* 80, 1944 (11–2).

Formulas are given for effective poison baits and repellents, and brief descriptions are given of two traps. Baits mixed with strychnine as a base are most useful; repellents that afford protection for an entire winter season and yet are not injurious to trees are composed of the chemical bases of lime sulphur, copper carbonate and asphalt emulsion.

45.3. *Insects*

45.3 : 12.26–8 : 13.2 : 12.19.22. KHAN, A. H., and CHATTERJEE, P. N. **Undergrowth in Teak plantations as a factor in reducing defoliation.** *Indian For.* 70, 1944 (365–9).

The chief factors controlling the Teak defoliators (*Hyblaea puera* and *Hapalia machaeralis*) have been found to be climate, and parasitic and predaceous insects. The many parasites are either specific or polyphagous with a varied selection of potential host

species, most of which live on plants other than Teak and are therefore at a disadvantage in a pure Teak plantation.

The main object of the study reported in this paper was to determine the relative effectiveness of parasitism of Teak defoliators in (1) plantations with an abundant growth of beneficial plants which support alternative hosts of the parasites, and in (2) plantations with a scanty growth of these plants. Results showed that normally parasite efficiency was distinctly better in (1) than in (2). It is therefore necessary to find means of maintaining and encouraging as much of the original useful mixture as is compatible with silvicultural principles. In the Coorg forests the experiment is to be made of saving about 10 per cent. of the coppice stumps of the beneficial species from burning, and maintaining the coppice growth below the Teak canopy.

45.3 : 12.26–8 : 13.2. ANDERSON, R. F. **The relation between host condition and attacks by the bronzed Birch borer.** *J. econ. Ent.* 37, 1944 (588–96).

For this study, young, vigorous, uninfested trees were selected and artificially injured in various ways so as to produce the effect of decadence. The attractiveness of these injured trees for the bronzed Birch borer (*Agrilus anxius* Gory) and their suitability for the development of the larvae were observed and compared with the same characteristics in uninjured trees. The work was done in northern Minnesota, where more than half all forest land is occupied by the Aspen-Birch type. *Agrilus anxius* breeds in both these trees.

The adults of this insect were attracted to and attacked the injured trees, those trees which had ceased to produce radial increment being most heavily attacked. Even the poorest of growing trees were unsuitable for the development of larvae. The results of this study suggest that, when *Agrilus anxius* is found in dying trees, it should not be considered the primary cause of death until all other factors which may have caused death have been investigated; this insect is not very aggressive and can successfully develop only in extremely decadent trees.

45.3 : 12.26–8 : 13.2. NASH, R. W. **Damage by the bronzed Birch borer in Maine.** *Bull. Maine For. Serv.* No. 13, 1943. pp. 12. [Also *Suppl.* No. 1, 1944. pp. 2.]

Study of this outbreak has been in progress since 1941 [cf. *For. Abstr.* 4 (254)]. The latest conclusions reached from study of the sample plots are as follows:—

(1) Injury had spread by 1943 so that almost the whole of the State was affected.

(2) Yellow Birch (*Betula lutea*) continued to have a higher degree of infestation and more severe injury than White Birch (*B. papyrifera*).

(3) The dominant trees had the highest percentage of infestation, severe injury and death, as well as the highest percentage of trees showing increase of injury in 1943. These percentages ran in direct order down to the suppressed class.

(4) There are some indications that the percentage of trees attacked is now lessening, probably because so many of the old and mature trees have already been attacked.

It is recommended that the problem should be met by utilization of Birch at maturity or when Birch stands are opened up by the cutting or killing of other tree species.

45.3 : 13.2. GÄBLER, H. **Abfaltern zur Bekämpfung der Nonne (*Lymantria monacha* L.). [Destruction of adults in the control of the nun moth (*Lymantria monacha* L.].** *Thar. forstl. Jb.* 94, 1943 (219–44). [G.] [Sächsische Forstliche Versuchsanstalt Tharandt.]

In forest regions where topography is such that insecticidal dustings by aeroplane or motor-dusters cannot be used against the nun moth (*Lymantria monacha* L.), destruction of the adults may play an important part in its control. An account is given of experiments carried out in the Tharandt area to test the effectiveness of killing the female moths by striking them with a metre-long rod having a rag attached to the end; under normal circumstances the majority of the female moths are found on the lower part of the trunk within reach of such a rod.

Results of experiments indicate that the systematic daily destruction of moths on a sufficient scale will go far to prevent the outbreak of a nun moth epidemic, especially if used in combination with trap bands; but where a heavy attack is already in progress more drastic methods will be necessary.

45.3 : 13.2. Ingen arsenik mot tallmätaren. [**Arsenic will not be used to control the Pine looper.**] *Skogen* 31, 1944 (245). [Sw.]

In the campaign against the Pine looper (*Bupalus pinniarius*), instead of using arsenic as had been intended, a new insecticide, Gesarol, is to be employed. It is considered to be particularly effective and is not dangerous to wild or tame forest animals. R. P. J.

45.3 : 12.25 : 13.2. CHRYSTAL, R. N. **Sucking insects. What they do, and some points about their work for the forester to consider.** *Sylva* No. 25, 1944–45 (21–2).

A brief account of some *Aphidae* and *Adelgidae*, and of certain of the unsolved problems in connexion with their effect on infested trees, particularly that of the *Adelges* on the Douglas Fir. The forester can collect much useful data on the general conditions in Douglas plantations of all ages up to the pole stage. He is recommended to ignore the masses of wool produced in the spring, and to examine the general state of growth later in the season, paying particular attention to the upper third of the stem, height growth, crown development, etc. This should all be correlated with data on the site factors. Such studies have not yet been made on a large scale in the United Kingdom, and, until they have been, the status of this insect as a forest pest cannot be certainly defined.

45.3 (410) : 13.2. TAYLOR, W. L. **Ornithology and forest insect pests.** *Forestry* 18, 1944 (1–11).

A project was authorized by the Forestry Commissioners during the winter 1941–2 having as its objects the attraction of more insect-eating birds to the hardwood inclosures in the Forest of Dean by providing artificially constructed nesting-boxes, and to ascertain the effect an increased bird population may have on the periodic outbreak of *Tortrix viridana*, *Cheimatobia brumata* and other defoliators. This article describes the experiment. In a 37-acre block of Oak 92 boxes have been erected, and in a 35-acre block containing Beech and Chestnut in addition to Oak, a further 70 boxes were installed, making a total of 162. The construction of the nexting-box is described and shown in a diagram. In 1944, 126 boxes (75 per cent.) were occupied, and were examined twice during the nesting season. A list of identified insects is given,

and also a census of bird species taken in 1942. The experiment is being continued.

45.3 (47.6) : 12.25 : 12.26–8 : 13.2 : 44.3. SCHEDL, K. E. Der forstliche Pflanzenschutz in der Ukraine. **[Forest plant protection in the Ukraine.]** *Forstarchiv* 19, 1943 (85–95). [G.]

From the point of view of forest protection against insect and other pests the Ukraine (excluding the Crimea) may be divided into three main zones: (1) the northern forest zone; (2) the wooded steppes; and (3) the true steppes on which windbreaks have been planted. The author reviews the commonest pests and diseases of Pine (which is highly valued as the only coniferous timber of the region) and the various hardwoods both in natural forest and in planted windbreaks. The tree species used for planting windbreaks vary greatly in their resistance to pests. Among the woody plants which suffer comparatively little damage are *Sophora japonica*, *Gleditsia triacanthos*, *Robinia pseudoacacia*, *Juglans regia*, *Morus alba* and *Elaeagnus angustifolia*. Field Maple is also very resistant. Common Ash, *Prunus serotina*, *Populus nigra*, Norway Maple and Lime are less immune, while Oak, which is particularly prized on account of its silvicultural characteristics, is very susceptible to various diseases and pests. The concluding section of the paper deals with control measures including aeroplane dusting.

45.3 (496) : 12.26–8 : 13.2. ACATAY, A. Istanbul çevresi ve bilhassa Belgrad Ormanındaki zararlı orman böcekleri, mücadeleleri ve işletme üzerine tesirleri. **[Insect pests of forests in the environs of Istanbul and especially in the Belgrade Forest, their control and effect on forestry.]** *Calişmalar yüksek Ziraat Ense. Ankara* No. 142. pp. [8] + 163. [Turk.g.] R.A.E. 32A, 1944 (433–4).

Records are given of the finding of some 200 species of insects and mites in the Belgrade Forest near Istanbul during a survey in 1939–40, with notes on the biology of some of them and suggestions for their control. It is pointed out that their biology differs in some cases from that of similar species in Europe; *Paranthrene* (*Sciapteron*) *tabaniformis*, Rott., which is a fairly serious pest of Poplars, and *Phalera bucephala*, L., are cited as examples.

45.3 (54.2) : 12.26–8 : 13.2. ANANDA RAU, S. **Report of the Entomologist 1942–43.** *Rep. sci. Dep. Tea Sect. U.P.A.S.I. 1942–43* 1943 (10–5). R.A.E. 32A, 1944 (433).

Insects on shade trees for Tea included a species of *Stenoscelis*, probably undescribed, that attacked *Grevillea* in Cochin. Injury resulted in the destruction of the cambial tissues of the stem, and it is not known whether this weevil is a primary pest. The only pest recorded on *Albizzia moluccana* during the year was *Terias* sp. Red Gum (*Eucalyptus rostrata*) in Cochin was infested by an unidentified termite which excavated a gallery inside the collar region without attacking the external wood. Damage by this species, which had not previously been observed, was associated with the growth of callus tissue in the collar region. Damage by other termites was slight.

45.3 (68) : 12.26–8 : 13.2. TOOKE, F. G. C. **The biological control of the Eucalyptus snout beetle, *Gonipterus scutellatus*, Gyll.** *Sci. Bull. S. Afr. Dep. Agric. For.* No. 235, 1942. pp. 16 + maps. R.A.E. 32A, 1944 (355–6).

This is a summarized report of investigations on the control of *Gonipterus scutellatus*, Gyll. on *Eucalyptus* in South Africa, by the egg-parasite, *Anaphoidea nitens*, Gir., which was introduced from Australia in 1926 and was first found to be established in 1927. During 1928–31, 620,000 individuals of this Mymarid were bred in the laboratory and liberated in the four provinces, and it is now believed to be present in every plantation in the infested areas. Control has been excellent in all areas except the dry high veldt; there it was very disappointing until 1938, but is now more satisfactory, though still very erratic. The reasons for the varying results obtained are discussed in some detail.

45.3 (71.3–4) : 12.25 : 13.2. BROWN, R. C. **The Spruce budworm.** *Leafl. U.S. Dep. Agric.* No. 242, 1944. pp. 4.

The serious outbreak of Spruce budworm [*Archips* (= *Cacoecia*) *fumiferana*] now occurring in the Provinces of Ontario and Quebec has already killed about 90 per cent. of the Balsam Fir and about 50 per cent. of the Spruce on some 12,000 or 15,000 sq. miles, and in addition has infested a further 30,000 sq. miles where 5 to 10 per cent. of the timber has been killed. This outbreak constitutes a serious threat to the Spruce/Fir forests of New England, New York and the Lake States, and the purpose of this leaflet is to provide a description of the insect and its feeding habits, so that everyone interested in the preservation of the northern coniferous forests may become familiar with its characteristics. The leaflet deals briefly with the history of the pest, its host trees, injury inflicted, life stages, and seasonal history.

45.3 : 13.2 : 23.26 (728.2). BRITISH HONDURAS. **Report of the Forest Department for the year ended 31st December, 1943.** Govt. Printer, Belize. 1944. pp. [8] + tables.

In attempts to control ant damage in nursery seedbeds, the pretreatment of seed by dusting with red lead or soaking in solutions of copper sulphate or corrosive sublimate proved ineffective, as did the placing of tarred wooden curbs around the beds; control was achieved at low cost by continual inspection of beds and surroundings and the destruction of ant nests and runways (p. 5).

45.3 : 12.25 (78.9 : 79.1) : 13.2. LITTLE, E. L. **Common insects on Pinyon (*Pinus edulis*).** *J. N.Y. ent. Soc.* 51, 1943 (239–52). H.S.B.

The insects observed on *Pinus edulis* in Arizona and New Mexico are grouped according to the part of the host tree that is attacked: (1) insects on foliage; (2) insects in bark; and (3) insects in cones and seeds. The first group includes Pine tip moths, scale insects, aphids, caterpillars, gall makers, cicadas and ants. *Matsucoccus acalyptus* and *Chionaspis pinifoliae* are among the leaf-eating insects which cause the greatest damage. The most important insects in the second group are bark beetles, particularly *Ips lecontei*, but various borers were also observed. Although pests of cones and seeds do not kill the trees, they are of very great economic importance, owing to their destruction of the edible Pinyon nuts. Gall midges, Pine cone moths (*Eucosma bobana*[?] and *Dioryctria* spp.), weevils (*Conotrachelus*

sp.) and Pinyon cone beetles (*Conophthorus edulis*) are among the cone and seed pests receiving mention.

45.3 (932–9) : 12.25 : 12.26–8 : 13.2. LEVER, R. J. A. W. **Insect pests of some economic crops in Fiji.** *Bull. ent. Res.* 35, 1945 (367–77).

The list includes *Crossotarsus saundersi* on *Hevea brasiliensis*; *Argyroploce* (*Cryptophlebia*) *illepida*, *Cryptoblabes plagioleuca*, *Striglina superior* and *Thalassodes pilaria* on the Tahitian Chestnut (*Inocarpus edulis*); and *Aeolarchis sphenotoma* and *Trachycentra chlorogramma* on the Screw Pine (*Pandanus thurstonii*).

46. DAMAGE BY MAN

46 (47.1). Krigsskadorna på finsk skog. [War damage in Finnish forests.] *Skogen* 30, 1943 (268). [Sw.]

The bureau established by the Finnish Ministry of Finance for valuing the damage to forests caused by the war has almost completed its work. The damaged forest area which has been valued up to the present, and which is situated mainly in the reoccupied parts of south-east Finland, comprises about 200,000 hectares and the damage has been computed at 500 million Finnish marks. It is calculated that the total damage will approximate to 600 million Finnish marks. R. P. J.

46 : 11.44 : 11.47.6. ROSENFELD, W. Die Schädlichkeit des Streurechens (an einem praktischen Beispiel nachgewiesen). [The harmfulness of raking litter (illustrated by a practical example).] *Thar. forstl. Jb.* 93, 1942 (519–33). [G.]

Ill-considered raking of litter has a deleterious effect on the physical, biological and biochemical properties of forest soils, not only making artificial regeneration difficult, but also preventing any natural reproduction. Long and intensive raking of litter also reacts unfavourably on the percentage of commercial timber produce and on the quality of the product. Figures are given for actual losses in timber volume and site class, but damage to the forest floor and to water economy, etc., can be assessed only indirectly.

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

52. **Notes on forest mensuration.** *Forestry* 18, 1944 (40–6).

The first note compares girth and diameter measurements at breast height in a Douglas Fir sample plot. Basal area calculated from the mean of the squares of two diameter measurements at right angles to each other should theoretically be greater than that calculated from the square of the mean of the two diameters, and that calculated from girth should be intermediate. In this case, basal area based on diameter measurements conforms to theory while that based on girth does not, the latter giving the largest area.

The second note provides an alternative graphical method of calculating the volume of a standing sample tree, the usual curve being replaced by a straight line.

The third note deals theoretically with the error resulting from calculating the volume of a tree on the basis of one measurement, with reference to conifers in Great Britain. For purposes of comparison field data are given showing the error. The British Forestry Commission has decided to abandon sectional measurement, at any rate during the present war.

52.4. *Measurement of Volume*

52.41. WILSON, S. E. **Decimal super and cubing calculator.** Lumberbook Company, Clevedon, Somerset. 1943. pp. 40.

The tables in this calculator give by direct reading the superficial measure corresponding to any length in feet and any commercial width from $\frac{1}{8}$ in. to $47\frac{1}{2}$ in. Cubic measure is obtained by multiplying the superficial measure in square feet by the thickness in inches and dividing the product by 12.

52.41 : 33.51. **Smith's pitprop tables. Home timber.** Lumberbook Company, Clevedon, Somerset. 1944. pp. 28. [The National Home Grown Timber Council.]

The tables in this booklet give: (*a*) the contents per piece for each size of prop commonly used, and for long timber such as is converted into props; (*b*) the solid contents of 100 lineal feet of each size of prop, related to weight according to the state of seasoning; (*c*) the quantity of timber described by lineal feet and by number of props that will weigh four tons at the average state of seasoning represented by the term '50 Hoppus feet to the ton weight'.

52.42. GRAY, H. R. **Volume measurement of single trees.** With comment by C. E. Lane-Poole. *Aust. For.* 8, 1944 (44–62).

Following an earlier article [cf. *For. Abstr.* 5 (286)] it is claimed that the height/diameter curve, in the 'main stem' of all normally grown forest trees, is parabolic; so that for this length, the height/sectional area relationship is linear. Apart from the variation in the height/diameter ratio of different trees, variation of 'taper' results chiefly from differences of stem profile in the crown and at the butt.

The 'taper line' is defined as the graphical linear relation, in the main stem, between height and sectional area. Projection of the taper line to intercept the vertical and horizontal axes at 'parabolic height' and 'parabolic base' respectively, gives a triangle, from which 'parabolic volume'—v_p—, can be computed, from the formula:—$v_p = \frac{1}{2}$ height $\times$ base. The units of measurements used in this article are feet, square feet and cubic feet, for height, sectional area and volume respectively.

For plantation grown coniferous trees, and for 'second growth' crops in general, experience suggests that parabolic volume will ordinarily be found to be a close approximation to total stem volume; and in such crops, therefore, to be a universal unit for comparative purposes. (For very large, old, umbrageously crowned and irregularly shaped trees, precise estimation of volume is not possible by any practicable method. Often when it is practicable, it may not be warranted, because of hidden defects, etc.)

Other important uses of the taper line method of measurement are detailed, e.g.:—

(1) Not only can tree measurement be checked in the field at the time of making them, but checks can be made, at any time, of measurements made by persons in other parts of the world.

(2) By comparison with other methods, estimation of total stem volume; merchantable volume; volume by assortments; and value of whole trees by assortments, is more accurate and much quicker.
(3) The measurement of standing trees, which is so important in research work, is greatly facilitated.
(4) Synthesis and analysis of growth measurements are simplified.
(5) Changes, as a result of treatment, in any part of the stem profile, or in bark thickness, can be detected most reliably by the taper line method of measurement, which is therefore the best method for scientific purposes which involve tree measurement.
(6) The technique outlined for the measurement of single trees can be generalized, so that it can be used for volume table preparation, which, however, is beyond the scope of the present article. *Author's summary.*

52.43. FITZPATRICK, H. M. **Some methods of estimating the volume of timber in woods and plantations.** *Irish For.* 1, 1944 (46–9).

The procedure in selecting and measuring trees and recording data, as a basis for estimating cubic volume of woods and plantations, is outlined. The methods vary only in the way the sample trees are selected; three such methods are described briefly—the arithmetical mean sample tree method, Urich's method, and Hartig's method.

52.43.2. PLUMLEY, L. P. **Log scaling.** New York State College of Forestry, Syracuse University. 1944. pp. 13.

A brief account is given of the log rules in use in New York State, and instructions for measuring logs, including trimming allowance, allowance for interior and exterior defects. Common log rules are given in 5 tables at the end of the pamphlet.

56. INCREMENT

56.02 : 12.25 : 43.3. STONE, E. E. **Effect of fire on radial growth of Longleaf Pine.** *Naval Stores Rev.* 52 (24), 1942 (14). [Southern Forest Exp. Sta.]

Measurements of annual radial growth on comparable trees in burned and unburned areas showed that for trees under 6 in. d.b.h. the growth during the first year after fire ranged from 0 to 65 per cent., averaging 23 per cent., less than trees on the unburned areas; decreases up to 35 per cent. and averaging 19 per cent. were measured for larger trees with higher crowns. Recovery in radial growth is usually very rapid.

56.02 : 07.7. HALL, R. C. **A vernier tree-growth band.** *J. For.* 42, 1944 (742–3).

This article describes, with illustrations, the construction, installation and use of a home-made instrument which makes possible the accurate measurement of diameter growth at any time during the growing season. It consists of a band of aluminium which is placed around the tree and held in place by a coil spring. The band is fitted with a vernier which permits a reading of 0·01 in.

56.04 : 12.26–8 : 01.7. HERRICK, A. M. **Multiple correlation in predicting the growth of many-aged Oak-Hickory stands.** *J. For.* 42, 1944 (812–7).

This article illustrates the use of multiple correlation in estimating volume growth per acre on small areas; the data were obtained from 28 permanent plots in the Oak-Hickory type of northern Indiana.

Of the variables studied, volume of growing stock per acre was found to be the best single criterion of volume growth. If number of stems, average d.b.h., and growth in d.b.h. are also taken in consideration, these four independent variables represent about four-fifths of the factors governing volume growth per acre.

The following equation may be used for predicting volume growth in Oak-Hickory stands:—

Volume growth = 102 + 0·017 (growing stock) + 1·59 (No. of stems) − 14·4 (av. d.b.h.) + 103 (growth in d.b.h.).

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

57 : 12.25 (43.1–5) : 63 : 55. WOBST, A. Die Wertleistung von Kiefer und Fichte in den preussischen Staatsforsten nach Standort und Umtriebszeit. [**The yield of Pine and Spruce in the Prussian State forests according to site and rotation period.**] *Thar. forstl. Jb.* 94, 1943 (187–217). [G.g.]

The article is in two sections, the first dealing with the influence of site and age on the yield of Pine and Spruce, the second giving a comparison of the yields of the two species. Much of the relevant data is tabulated.

57.4 : 07.2. ROBERTSON, W. M., and MULLOY, G. A. **Sample plot manual.** *Misc. Ser. Dom. For. Serv.* No. 4, 1944. pp. 60 + charts and tables.

This bulletin is essentially a guide to procedure in the location, establishment, survey and measurement of sample plots, and in the recording and compilation of data, the greater part of the text dealing with work on permanent sample plots. Notes are also given on transect sample plots and line plots; single-examination plots, subplots, quadrats and Raunkiaer plots; the calculation of stand density; time and cost records: demarcation posts and signs; instruments; and reports.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60.3. *Management of Different Classes of Forest*

60.31 (68.9) : 66 : 24.3. WILKINSON, T. L. **The management of indigenous woodlands.** *Repr.* from *Rhod. agric. J.* 41, 1944 (200–7).

A general article on the management of indigenous woodlands in Matabeleland, dealing with problems relating to the cultivation of new land, improving grazing land, management of farm woodlands, and cutting by miners, firewood contractors and others.

60.31 (77.6) : 12.26–8 : 12.19 : 21 : 23–4 : 56. DETERS, M. E. **Silvicultural aspects of woodland management in southeastern Minnesota.** *Tech. Bull. Minn. agric. Exp. Sta.* No. 157, 1943. pp. 71.

The study reported in this bulletin was made in southeastern Minnesota to obtain data on which to base the planned management of the forests of that region. Growth rates, silvicultural characters of the

important tree species and forest ecology were the main aspects of the study.

The region investigated has a total area of 6,530,560 acres, of which 12·3 per cent. is forested. The forests are of two principle associations, the Oak/Hickory, which occupies the comparatively drier sites, and the Maple/Basswood occupying the moister sites.

The Oak/Hickory forests are composed mainly of even-aged stands, more than half of which became established as a result of the cessation of annual or periodic fires during the two decades following settlement of the region. The most important species of this association are Red Oak (*Quercus borealis* and *Q.b. maxima*), White Oak (*Q. alba*), Bur Oak (*Q. macrocarpa*), and Pin Oak (*Q. palustris*); the occurrence of these species on different sites showed that they can be classified in order of increasing moisture requirements as follows: (1) Bur Oak, (2) Pin Oak; (3) White Oak, and (4) Red Oak.

Little evidence was found to indicate successional changes in upland Oak stands. On the moister sites, however, climax species of the Maple/Basswood association were reproducing to a limited extent in Oak-dominated stands, and the composition of subdominant vegetation suggests that the climax Maple/Basswood association will evolve on some of these relatively moist areas.

Oak reproduction was found to be almost entirely by coppice shoots, only 8 per cent. being from seed. Aspen and Birch are becoming increasingly important because of their abundant establishment on cut-over areas.

A comparison of 14 selected Oak stands values with normal yield table values showed that stands far below normal with respect to number of trees per acre may be practically normal with respect to basal area and far above normal in terms of mean tree diameter.

Group selection, shelterwood, and clear cutting in narrow strips or small blocks are the silvicultural systems recommended for management of Oak/Hickory high forests. The selection system is recommended for Maple/Basswood forests.

60.31 : 12.25 (78.9) : 56 : 57.6. PEARSON, G. A. **Growth, mortality, and cutting cycles in New Mexico Ponderosa Pine.** *J. For.* 42, 1944 (901–5). [Southwestern Forest and Range Exp. Sta., Tucson, Ariz.]

This article summarizes an analysis of growth and mortality as measured in sample plots of Ponderosa Pine established in New Mexico between 1910 and 1915. The findings are specific and agree in all essential particulars with those reported from sample plots established in Arizona [cf. next abstract]. All the New Mexico plots point to advantages of a short cutting cycle and to the benefits that would have resulted from a systematic opening up of groups, both Yellow Pine and Blackjack, in the first cutting.

60.31 : 12.25 (79.1) : 24.3 : 56. **Ponderosa Pine management conference, Fort Valley Experimental Forest.** *J. For.* 42, 1944 (921–2).

An account of a conference held at Fort Valley Experimental Forest, Arizona, where during the last 30 years some 40,000 trees have been measured and recorded individually and fairly large areas of Ponderosa Pine forest have been harvested, restocked, and harvested a second time, yielding much valuable information for a programme of intensive forest management. From the records available it is concluded *inter alia* that although growth is slow and mortality high, considerable net increment may be expected: a 120-acre area has yielded a mean net annual increment of 47 bd. ft. during the past 25 years.

Residual volume is a poor indicator of yield capacity unless supplemented by data on number, size and age of trees and their distribution. Cut-over stands usually show a relatively high rate of increment during the first 10 years after cutting, they decline moderately during the second 10 years, and precipitately during the third 10 years.

Cutting practice has shown no visible effect on reproduction provided enough seed trees are left.

After a decade of experimentation, stand improvement in the southwest has been reduced to two primary measures: (1) Relief from competition by elimination of undesirable dominants, and (2) favouring desirable types by release and pruning.

60.31.2 (71.1) : 22.11 : 12.25 : 90. MACMILLAN, H. R. **The new forest on logged-over lands of the Alberni Pacific Lumber Co. Ltd., Port Alberni, B.C.** H. R. MacMillan Export Co. Ltd. [Vancouver, B.C.] 1944. pp. 23 + map.

This popular illustrated bulletin describes measures being taken to ensure regeneration of Douglas Fir on the forest lands of the Alberni Pacific Lumber Co. Ltd., in the Ash River Valley on the coast of British Columbia. The forest is logged by the 'patch' system [cf. *For. Abstr.* 4 (99)] and it appears that two-thirds of the area logged since 1938 is now satisfactorily restocked. Descriptive signs have been erected at representative points throughout the area to inform the public on the problems of reforestation.

60.31.2 (73): 24.4 : 32 : 97.2. TILLOTSON, C. R. **Care and improvement of the farm woods.** *Fmrs.' Bull. U.S. Dep. Agric.* No. 1177, (revised ed.) 1941. pp. 25.

A slightly revised version of a pamphlet issued by the U.S. Department of Agriculture to aid farmers in the management of their woods. It deals with types of woods, density, species of trees, improvement cuttings, pasturing, fire protection, insects and diseases, care in logging, perpetuating the stand, and growth rates of different species in various parts of the United States.

60.31.2 (73) : 97.2 : 94.4. TILLEY, W. B. **American tree farms.** *J. For.* 42, 1944 (796–9).

Tree farming is essentially a popularized term for forest management, applied particularly in the western United States to areas dedicated to timber production under certain specified conditions. The first tree farm was dedicated in the State of Washington in 1941 and by July 1, 1944, the American Tree Farm System had certified more than 8 million acres of forest land representing between 500 and 600 separate tracts in eight States.

The majority of tree farms at present are owned by single individuals or corporations, but there is an increasing degree of co-operation, by which owners of adjacent forest areas combine to employ technical foresters.

Any forest owner desiring to have his land certified as a tree farm may apply to his regional tree farm authority. To have the area accepted and registered the owner must undertake to maintain and manage the area for sustained yield of forest crops and provide

periodic information on his progress, future plans; and improvements in fire protection and cutting practices.

60.31.2 (73) : 97.2. PRESTON, J. F. **New concepts in farm forestry.** *J. For.* 42, 1944 (725–9).

The author discusses some new aspects of the problems of American farm forestry disclosed by conservation surveys of the Soil Conservation Service, and emphasizes the need for more instruction to farmers from the Soil Conservation and Forest Services in planning their farms so as to include forestry as part of the farm business, as well as giving assistance in the application of forestry techniques and sale of forest products.

60.31.2 : 12.19.2. (74) : 4 : 22.12–4 : 23.1–2. **Recommended forest practice standards for New England.** With foreword by J. D. Curtis and comment by R. C. Hawley. *J. For.* 42, 1944 (716–25).

The recommended standard practices with respect to forest protection, cutting and regeneration in New England, as presented in this report, are considered by the Committee to meet minimum requirements only, and it is emphasized that, wherever possible, higher and more intensive standards should be adopted.

For each of the main forest regions (Spruce/Fir, Beech/Birch/Maple, White Pine/transition hardwoods, Pine/Oak, and Oak) data are given on location, composition, forest conditions and cutting standards. In all regions some form of partial cutting is generally advocated, with clear cutting to be used only under certain specified conditions.

In commenting on the report R. C. Hawley suggests that the promulgation of detailed standards of the type recommended by the Committee will not give satisfactory results; preferably cutting should be regulated by the basic concept 'keep forest lands productive', the interpretation and application of this concept being left largely to local advisory boards to meet the requirements of individual operations.

60.31.2 (74.2). RECKNAGEL, A. B., and HEBB, H. C. **Common sense forestry in northern New Hampshire.** *J. For.* 42, 1944 (925).

The St. Regis Paper Company owns nearly 100,000 acres in the town of Pittsburg, Coos County, New Hampshire, and in 1941 made a forest survey and timber estimate covering about a quarter of the area. A conference held in March, 1942, to review the results and plan for the future, led to the adoption of the following tentative notes for wood operations:—

(1) No Spruce or Fir below 6 in. d.b.h. to be cut except in building roads and skidways.
(2) Hardwoods to be used for roads, bridges, skidways, etc.
(3) Softwoods (Spruce and Fir) may be cut to 6 in. d.b.h. if sufficient reproduction is present.
(4) Where reproduction is insufficient, the space between sound thrifty softwood trees should not be greater than 12 ft.
(5) The usual provision to be made for top, stump, fire prevention, etc.

60.31.2 (74.9). MOORE, E. B. **Progress report on private forestry in New Jersey.** *J. For.* 42, 1944 (729–33).

The intensive forestry service for privately owned woodlands offered by the State of New Jersey with federal co-operation under the Norris-Doxey Law, has been expanded to meet war needs. This article presents some of the technical developments of the past five years, with figures of costs and results. The author believes that on small tracts in New Jersey a cutting cycle of about 20 years is more practicable than an annual cycle with corresponding sub-division of the area under management.

60.31.2 (79.7) : 22.14.2. HARPER, F. B., and BONNEY, M. C. **Selective cutting on Cowlitz Project.** *Soil Conserv.* 10, 1944 (102–7).

An account of the Cowlitz Farm Forestry Project, a co-operative forestry scheme covering 270,000 acres in Washington. The primary aim of the project is to demonstrate and encourage widespread adoption of better cutting practices, using the owners' own labour and treating the farm woodland as a permanent, income-producing 'crop'. A plan is worked out for each farm, based on the ability of the land to produce this or that crop.

61. SURVEYING. MAPPING

61.3 (74.5) : 97.1. BUTTRICK, P. L. **The forests of Rhode Island.** *Amer. Forests* 50, 1944 (440–2, 446).

The Forest Resource Appraisal carried out by the American Forestry Association in co-operation with the State Forestry Services, is designed to give the American public a State-by-State report on American forests after four years of war. Rhode Island was selected as the first unit to be covered in the Northeast on account of its small area, accessible forests, and the existence of a complete set of excellent large-scale aerial photographs. The appraisal follows two distinct lines of enquiry. One is a physical inventory of the forests in order to ascertain (1) their area, by (*a*) forest types and (*b*) size or age-classes; (2) their total volume by these same divisions expressed in cords, cu. ft. and thousand bd. ft.; (3) their probable volume of usable wood ten years hence, assuming protection from fire and freedom from unwise cutting. The second line of enquiry consists of a study of present uses, conditions of management, owner attitudes, taxation, fire protection, etc.

61.31 (68.9) : 12.26–8. SOUTHERN RHODESIA. **Report of the Secretary, Department of Agriculture and Lands, for the year 1940.** Govt. Stationery Office, Salisbury. 1941. pp. 45.

An extensive survey has just been completed of the indigenous Rhodesian 'Teak' (*Baikiaea plurijuga*) forests with the object of ascertaining the stocking of commercial and potentially commercial timber species and as a basis for sustained-yield forest management. The survey covered over 1 million acres of land (p. 31).

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

64 : 12.25 (410) : 56.01. FOGGIE, A. **On the determination of quality class by 'top' height instead of mean height for conifers in Great Britain.** *Forestry* 18, 1944 (28–39).

Mean height or mean crop height as used as the quality class index in the Forestry Commission yield tables is discussed. Dominant height as used in America and top height as used in India as alternative quality indices, are defined and discussed. The investigation of the correlation between top height and mean height in even-aged plantation crops is described, and the resulting regression lines and statistics for European Larch, Scots Pine, and Norway Spruce are

given. Comparative curves for mean height and top height of European Larch and tables of top height by age for the quality classes of the Commission's yield tables for all species are given.

From this study it appears that for the species dealt with (Scots and Corsican Pine, European and Japanese Larch, Norway and Sitka Spruce, and Douglas Fir) mean crop height is an acceptable index of site quality. Top height, however, has the advantage of greater simplicity in its determination and in use in mixed crops.

64 : 12.26–8 (77.5). GEVORKIANTZ, S. R., and SCHOLZ, H. F. **Determining site quality in understocked Oak forests.** *J. For.* 42, 1944 (808–11).

Stands of mixed Oak in southwestern Wisconsin are generally understocked, and the accepted index of site quality—relation between age and height of dominant trees—has not proved applicable. This study shows that the product of average basal area and average height of dominant trees affords a good measure of site quality, as it is unaffected by the degree of stocking within a range of 50 to 120 per cent. of normal.

65. DESCRIPTION OF GROWING STOCK

65.1 : 60.31.2 (485) : 92. LEWIS-JOHNSSON, M. **Begreppet 'yngre skog' in 1923 års skogsvårdslag. [The concept 'younger forest' in the forest conservation law of 1923.]** *Skogsägaren* 20, 1944 (188–90, 193–5). [Sw.sw.]

'Younger forest' is a new term introduced into Sweden's forest terminology by the law of 1923. Expressions used previously were young forest, medium-aged forest and old forest.

'Younger forest' is forest the value of which as a remaining means of production is considerably greater than the profit which could be withdrawn by immediate felling.

To ascertain how the concept 'younger forest' is interpreted in practice a circular letter was sent to 24 forest conservation committees, of which 21 supplied information from which it can be established that: (1) forest of which the expectation value is considerably greater than the realization value should be classed as younger forest; (2) the upper limit of this class is based not so much on actual age as on maturity of the growing stock; (3) the question as to whether a forest is 'younger' must be decided for each case after examining the stand in question; (4) conflict rarely occurs between forest owners and the forest conservation committee in connexion with the 'younger forest paragraph', and the text of the law appears to be suitable and the law to fulfil its object as a protection for immature forest, and at the same time to contribute to a more economic management of the private forest. R. P. J.

65.7 : 22.82.1. MULLOY, G. A. **Stand density vs. stand bole area and stand intensity indices in even-aged stands.** *For. Chron.* 20, 1944 (167–70). [Dominion Forest Service, Ottawa.]

In analysing data from even-aged Red and White Pine stands it is shown that when the results obtained by (1) plotting number of trees per acre over average diameter on double-logarithmic paper (S.D.I.), and (2) multiplying average diameter (in.) by average height (ft.) by number of trees per acre (S.B.I.), are brought to a comparable basis they provide the same relative measure of density index [cf. *For. Abstr.* 5 (289)]. Another measure of stand density that has been used is obtained by dividing the total volume in cu. ft. by the average height (S.I.I.).

8. ADMINISTRATION

81. ORGANIZATION. REGULATION OF SERVICE

81 : 07.2. CHAPMAN, H. H. **Continuity of service as a prerequisite to success in forest production.** *J. For.* 42, 1944 (873–6).

The thesis of this paper is that satisfactory progress in forestry, both in administration and research, is dependent on keen observation and continuous study by the same men in the same place for a period long enough to enable them to become thoroughly familiar with all the factors involved.

82. LABOUR QUESTIONS

82 (76) : 60.3. REYNOLDS, R. R. **Employment requirements of well-managed timberland in the lower south.** *J. For.* 42, 1944 (898–900). [Crossett Experimental Forest, Ark.]

An estimate is made of the number of man-hours per year necessary for forest maintenance, harvesting and primary manufacturing of the products of well-managed forests on the basis of experience at the Crossett Experimental Forest, Arkansas. The forest is mostly second-growth stands of the Shortleaf Pine/Loblolly Pine/hardwood type. Manpower requirements in terms of 8-hour man-days per year on 1,600 acres work out as follows:—

	Man-days
Overhead work (road development and maintenance, fire prevention and suppression, general supervision, marking and scaling, equipment maintenance, and crew supervision)	460
Direct work (cutting, loading, hauling, and milling or processing)	4,319
	4,779

Labour requirements for the woods and primary manufacturing operations are thus 3 man-days per acre per year.

86. ADMINISTRATION REPORTS

86 (54.4) : 90 : 45.11 : 23.3. HOWARD, Sir H. **Note on a tour in Jaipur State.** [Forest Research Institute, Dehra Dun.] 1944. pp. iv + 14.

86 (54.4) : 90 : 45.11 : 23.3. HOWARD, Sir H. **Note on a tour in Jodhpur State.** [Forest Research Institute, Dehra Dun.] 1944. pp. vi + 15.

The forests dealt with in these two notes are similar in type and present condition. The principal species are *Acacia leucophloea, Anogeissus pendula, Capparis*

hylla and *C. auriculata*, *Prosopis spicigera* and *zyphus jujuba*, in rocky hill country much denuded, nd eroded and overgrazed. The rainfall varies from out 10 to 25 inches but the soil is fertile where there is ough moisture. Similar recommendations are made r the improvement and future management of the rest lands in both Jaipur and Jodhpur States. A rest policy, survey and re-classification of land and a rge expansion in the forest staffs are needed. Over rge areas, protection and regulation of grazing alone ould improve the forests in a few years at small cost. or artificial afforestation watering is essential; never-eless given water for only one or two years, species ich as *Acacia arabica, A. catechu, Albizzia lebbek, zadirachta indica, Prosopis juliflora* and *P. spicigera* ould be grown; suitable technique for dry forest work described in *Indian For. Rec.*, III, No. 8 and IV, No. 4. me expenditure may be necessary for afforestation waste land placed under the Forest Department; mission of land revenue might encourage villagers to ltivate and sow forest trees, which could remain as llage property if properly managed under working ans.

6 (54.4) : 38.63 : 23.22.2. HOWARD, Sir H. **Note on a our of inspection of Sind forests.** [Forest Research nstitute, Dehra Dun.] 1943. pp. 10 + plates.

A description of the work of the Sind Forest Department which, by successful application of irrigation, has 'converted an inhospitable desert into a smiling and lovely land'. The various classes of forests include:—(*a*) Riverain forests of *Acacia arabica, Populus euphratica, Prosopis spicigera* and *Tamarix* which are annually flooded from spill water during the floods of the River Indus; these are managed on the selection system, natural regeneration being supplemented by line or broadcast sowings of *A. arabica* and *Prosopis spicigera* as the floods go down. (*b*) Forests outside the two protective bunds parallel to the bed of the Indus, which receive water only occasionally from bund sluices or breaches, or are irrigated intentionally from barrage and inundation canals between April and September. The canal-irrigated forest land is regenerated by the agri-silvicultural system, *A. arabica* and Mulberry being chiefly used, on a rotation of probably 15 years; the trees are sown in lines 33 or 40 ft. apart and field crops are cultivated for 5 years. It is suggested that this agri-silvicultural system may well become a widespread and recognized form of land culture not only in Sind but over vast areas in the Punjab, Rajputana, the plains of the United Provinces, upper Bihar, etc.

9. FOREST POLICY

(54) : 97.1 : 98.1 : 60.3 : 11.62.11. HOWARD, Sir H. **ost-war forest policy for India.** Govt. of India Press, lew Delhi. 1944. pp. 49 + maps.

The existing policy, which dates in written form from 394 and in practice from 30 years earlier, is reviewed the light of the present position and found to be xcellent in principle but to require amplification in ertain practcal aspects. Thus the proportion of the ountry as a whole, or of its several parts, that should e under forest, is not indicated, nor are the measures be taken to build up to the necessary figure where ere is already a deficiency. This note suggests that ie area should be at a minimum of 20–25 per cent., roperly distributed, and shows that only in Peninsular ndia are the forest areas at all adequate in extent or istribution. There are big areas of largely unroductive land of different types in most of the rovinces, which could be brought into production. his would probably require a further measure of ontrol over private forests, and special legislative ction is recommended, as the relevant chapter of ie current Forest Act has been found ineffective.

The chief problem is to provide easily accessible upplies of fuel and small timber throughout the gricultural village lands to put an end to the burning f cattle dung (enough to manure adequately 13 per ent. of the whole area of cultivation), which ought to o into the soil, and so raise the standard of life. This ould be done by bringing more Government waste nd under forest, afforesting more private land, and xercising a measure of legal control over the manageent of private forests. The government forests are eing worked under plans on the principle of sustained ield and it is not considered that the steady improveent which is taking place in them can be much enanced, though early revisic of the working plans is ecessary in view of the fellings that have taken place uring the war—they are six or seven years in advance.

It is considered that in the areas under the Forest Department, erosion is fairly well controlled, but that it is serious over extensive, denuded, heavily grazed and annually burnt lands. Widespread floods with consequent loss of life and property are traceable to this mismanagement of the land, as also is desiccation which is thought to be spreading eastwards from the western dry belt with less than 30 in. rainfall. The appointment of soil conservation officers within the Forest Department is recommended, a start having already been made in four provinces.

Proposals are made for the more efficient administration of research at the Research Institute at Dehra Dun. The position with regard to forest education is reviewed and only minor alterations proposed. The creation of a Federal Forest Service for centralized activities such as research, and soil conservation advice to Indian States, is practicable and recommended for serious consideration.

90. GENERAL PRINCIPLES OF FOREST POLICY

90 (410) : 94.3. BOOTH, H. A. **'To dedicate or not to dedicate'.** *J. Land Agents' Soc.* 43, 1944 (189–92).

A discussion, from the point of view of the private woodland owner, of the pros and cons for accepting the option, put forward in the British Forestry Commission's post-war forest policy proposals, of receiving a planting grant at the rate of £7 10*s.* per acre plus a maintenance grant of 2*s.* 6*d.* per acre for 15 years on new plantations and productive woodland. The conclusions reached are that, before such a decision can be made, more information is needed on the terms of the grant and the conditions under which planting would have to be done. The owners own circumstances and the present condition of the woods must also be taken into account.

90 (71) : 09.4. LECLAIRE, W. J. **Canada's forest**

species, most of which live on plants other than Teak and are therefore at a disadvantage in a pure Teak plantation.

The main object of the study reported in this paper was to determine the relative effectiveness of parasitism of Teak defoliators in (1) plantations with an abundant growth of beneficial plants which support alternative hosts of the parasites, and in (2) plantations with a scanty growth of these plants. Results showed that normally parasite efficiency was distinctly better in (1) than in (2). It is therefore necessary to find means of maintaining and encouraging as much of the original useful mixture as is compatible with silvicultural principles. In the Coorg forests the experiment is to be made of saving about 10 per cent. of the coppice stumps of the beneficial species from burning, and maintaining the coppice growth below the Teak canopy.

45.3 : 12.26–8 : 13.2. ANDERSON, R. F. **The relation between host condition and attacks by the bronzed Birch borer.** *J. econ. Ent.* 37, 1944 (588–96).

For this study, young, vigorous, uninfested trees were selected and artificially injured in various ways so as to produce the effect of decadence. The attractiveness of these injured trees for the bronzed Birch borer (*Agrilus anxius* Gory) and their suitability for the development of the larvae were observed and compared with the same characteristics in uninjured trees. The work was done in northern Minnesota, where more than half all forest land is occupied by the Aspen-Birch type. *Agrilus anxius* breeds in both these trees.

The adults of this insect were attracted to and attacked the injured trees, those trees which had ceased to produce radial increment being most heavily attacked. Even the poorest of growing trees were unsuitable for the development of larvae. The results of this study suggest that, when *Agrilus anxius* is found in dying trees, it should not be considered the primary cause of death until all other factors which may have caused death have been investigated; this insect is not very aggressive and can successfully develop only in extremely decadent trees.

45.3 : 12.26–8 : 13.2. NASH, R. W. **Damage by the bronzed Birch borer in Maine.** *Bull. Maine For. Serv.* No. 13, 1943. pp. 12. [Also *Suppl.* No. 1, 1944. pp. 2.]

Study of this outbreak has been in progress since 1941 [cf. *For. Abstr.* 4 (254)]. The latest conclusions reached from study of the sample plots are as follows:—

(1) Injury had spread by 1943 so that almost the whole of the State was affected.

(2) Yellow Birch (*Betula lutea*) continued to have a higher degree of infestation and more severe injury than White Birch (*B. papyrifera*).

(3) The dominant trees had the highest percentage of infestation, severe injury and death, as well as the highest percentage of trees showing increase of injury in 1943. These percentages ran in direct order down to the suppressed class.

(4) There are some indications that the percentage of trees attacked is now lessening, probably because so many of the old and mature trees have already been attacked.

It is recommended that the problem should be met by utilization of Birch at maturity or when Birch stands are opened up by the cutting or killing of other tree species.

45.3 : 13.2. GÄBLER, H. **Abfaltern zur Bekämpfung der Nonne (*Lymantria monacha* L.).** [**Destruction of adults in the control of the nun moth (*Lymantria monacha* L.).** *Thar. forstl. Jb.* 94, 1943 (219–44). [G.] [Sächsische Forstliche Versuchsanstalt Tharandt.]

In forest regions where topography is such that insecticidal dustings by aeroplane or motor-dusters cannot be used against the nun moth (*Lymantria monacha* L.), destruction of the adults may play an important part in its control. An account is given of experiments carried out in the Tharandt area to test the effectiveness of killing the female moths by striking them with a metre-long rod having a rag attached to the end; under normal circumstances the majority of the female moths are found on the lower part of the trunk within reach of such a rod.

Results of experiments indicate that the systematic daily destruction of moths on a sufficient scale will go far to prevent the outbreak of a nun moth epidemic, especially if used in combination with trap bands; but where a heavy attack is already in progress more drastic methods will be necessary.

45.3 : 13.2. Ingen arsenik mot tallmätaren. [**Arsenic will not be used to control the Pine looper.**] *Skogen* 31, 1944 (245). [Sw.]

In the campaign against the Pine looper (*Bupalus pinniarius*), instead of using arsenic as had been intended, a new insecticide, Gesarol, is to be employed. It is considered to be particularly effective and is not dangerous to wild or tame forest animals. R. P. J.

45.3 : 12.25 : 13.2. CHRYSTAL, R. N. **Sucking insects. What they do, and some points about their work for the forester to consider.** *Sylva* No. 25, 1944–45 (21–2).

A brief account of some *Aphidae* and *Adelgidae*, and of certain of the unsolved problems in connexion with their effect on infested trees, particularly that of the *Adelges* on the Douglas Fir. The forester can collect much useful data on the general conditions in Douglas plantations of all ages up to the pole stage. He is recommended to ignore the masses of wool produced in the spring, and to examine the general state of growth later in the season, paying particular attention to the upper third of the stem, height growth, crown development, etc. This should all be correlated with data on the site factors. Such studies have not yet been made on a large scale in the United Kingdom, and, until they have been, the status of this insect as a forest pest cannot be certainly defined.

45.3 (410) : 13.2. TAYLOR, W. L. **Ornithology and forest insect pests.** *Forestry* 18, 1944 (1–11).

A project was authorized by the Forestry Commissioners during the winter 1941–2 having as its objects the attraction of more insect-eating birds to the hardwood inclosures in the Forest of Dean by providing artificially constructed nesting-boxes, and to ascertain the effect an increased bird population may have on the periodic outbreak of *Tortrix viridana*, *Cheimatobia brumata* and other defoliators. This article describes the experiment. In a 37-acre block of Oak 92 boxes have been erected, and in a 35-acre block containing Beech and Chestnut in addition to Oak, a further 70 boxes were installed, making a total of 162. The construction of the nexting-box is described and shown in a diagram. In 1944, 126 boxes (75 per cent.) were occupied, and were examined twice during the nesting season. A list of identified insects is given,

plant at the end of a shower has been divided into three parts or types of storage:—

(*a*) 'Transitory storage', or the water that will drain from the plant under still air conditions.

(*b*) 'Conditional storage', or the additional water that can be removed by wind or forceful shaking.

(*c*) 'Residual storage', or the water that can be removed only by evaporation.

2. Under still air conditions, 72 per cent. and 68 per cent. of the maximum surface detention for *B. pilularis* and Monterey Pine, respectively, can be retained as interception; and under severe wind conditions, 35 per cent. and 34 per cent. of the maximum surface detention can be so retained.

Interception storage capacity varies between 0·01 and 0·04 in. depth for Monterey Pine transplants and between 0·02 and 0·06 in. for *Baccharis*.

Linear relationships exist between oven-dry weight of leaves and maximum surface detention, surface detention after drip, and surface detention after shake; and also between the time required to reach the point of maximum surface detention and oven-dry weight of leaves.

B. pilularis retains a larger quantity of water per unit of leaf area than does Monterey Pine. *From authors' summary.*

91.8. *The Forest as a Source of Employment and Income*

91.8 (79.5 : 79.7) : 23.24 : 43.11. **Postwar forestry projects planned by forest agencies in the Puget Sound area. Report of Committee on Postwar Planning in Forestry, Puget Sound Section, Society of American Foresters.** *J. For.* 42, 1944 (870–2).

Results are given of a survey made by a committee of the Society of American Foresters for post-war development and improvement on the forest lands of the Puget Sound area. The proposed work, which includes planting, snag-felling, road-building, etc., involves the expenditure of $15 million, which will create 1,600,000 man-days employment.

92. FOREST LAW

92 (41.5) : 09.1 : 23.24. ANDERSON, M. L. **Items of forestry interest from Irish Statutes prior to 1800 A.D.** *Irish For.* 1, 1944 (6–26).

Extracts from forestry legislation from 1634 to 1784, together with an analysis of the numbers of the various tree species planted in 1810, 1829 and 1844, compared with those planted in 1943.

92 (74.4) : 60.31.2. LAMBERT, J. H. **Massachusetts' Forest Cutting Practices Law.** With comments by A. C. Cline and H. H. Chapman. *J. For.* 42, 1944 (799–804).

An account is given of a bill recently before the Massachusetts legislature, the object of which is to improve cutting practices on privately owned forest land; the forest cutting practices recommended by the State Forestry Committee are quoted in full. Although the law is commonly referred to as a 'regulatory' one, it imposes no penalties on owners who fail to follow these recommendations.

A. C. Cline criticizes the provisions of the bill on several grounds, notably that practically all cuttings made in farm woodlots are exempted, and that the recommended seed-tree method will not necessarily provide regeneration in either hardwood or White Pine stands in this region. He also deprecates the emphasis on restocking after cutting, since the practice of clear cutting has been the chief single factor in the decline of Massachusetts forests in the last 50 years.

94. FOREST OWNERSHIP

94.1 (78.9 : 79.1) : 09.4 : 60.31.1. **National forest facts, Southwestern Region, Arizona and New Mexico, 1944.** U.S. Forest Service [Washington, D.C.] 1944. pp. 47.

Information is given for the national forests in Arizona and New Mexico under the headings: origin, operation, timber management, wildlife and range management, recreation and lands, engineering, fiscal control, and miscellaneous.

94.3 (410) : 60.31.2. MACDONALD, J. **Some impressions of private forestry.** *Forestry* 18, 1944 (12–20).

With reference to Great Britain. The generally poor conditions of estate woodlands in England is attributed partly to the apathy of landowners, partly to sporting interests which conflict with forestry interests. In Scotland conditions appear to be much better, and this is thought to be due to the larger size of woodland estates, so that either a good forester is employed or the owner himself becomes a keen forester. In addition, conditions of management in Scotland are easier than in England.

The chief weaknesses of English woodlands are stated to be:—

(1) Poor stocking, and hence low productivity. This is due to selective cutting over a long period, bad silvicultural systems, and faulty choice of species.

(2) Bad arrangement of age classes, owing to changing policy, the break-up of large estates into smaller properties, and the heavy fellings of the last war. This will create marketing difficulties as a regular flow of produce from a single estate will be impossible.

(3) Overcrowded young plantations, owing to neglect of thinning.

(4) Lack of drainage.

(5) Lack of shade-bearing species, resulting in a luxuriant weed growth which is inimical to regeneration. Allied to this is the raising of unsuitable mixtures.

Suggested measures for improving the condition of the woodlands are (1) the thinning of young and middle-aged plantations, and of older woods which are capable of improvement; (2) the formation of new plantations: (3) the treatment of poorly stocked old woodlands by whatever methods are most suitable.

94.3 (41.5) : 23.21 : 44.2 : 12.26–8. MAGAN, A. T. S. **Some notes on the private forests of Ireland, past and present.** *Irish For.* 1, 1944 (36–41).

Notes on some individual Irish forests, including a natural Oak forest where regeneration has now ceased owing to infestation by ivy. It is suggested that Redwood might be profitably grown in Ireland. Two trees of this species planted 70 years ago in Co. Meath now measure 160 cu. ft. per tree.

94.3 (76.3) : 60.31.2 : 12.25. FOLWEILER, A. D., and VAUX, H. J. **Private forest land ownership and management in the Loblolly/Shortleaf type of Louisiana.** *J. For.* 42, 1944 (783–90).

This article presents certain characteristics of private land ownership in the Loblolly/Shortleaf type in

Louisiana and suggests ways of obtaining more widespread forest management in this area.

94.4 : 60.31.2 : 33.1 : 98.3. KISSIN, I. **Co-operation in forestry.** *Tech. Commun. Imp. For. Bur.* No. 2, 1944. pp. 72. [E.span.port.]

This Communication makes a survey of co-operative societies in forestry on the basis of a comparatively wide range of evidence obtained from the literature and by direct enquiry.

Chapter I is a general discussion of the nature of co-operation and of the main categories of co-operative effort in forestry, and of the activities, organization, and finance of societies of forest owners.

Chapters II–V contain a detailed study of the existing British co-operative forestry societies and a fairly detailed account of the societies of forest small-holders in Denmark, the forest management societies of Finland, and certain farm-woodland co-operatives in the U.S.A. In each case consideration is given to the forestry background against which the societies have developed, and to their history, organization, finance, membership, and activities.

A summary of available information on other societies of forest owners, and on certain agricultural co-operative societies that market forest produce, is given in Chapter VI. This covers various organizations in European countries, notably Sweden, Norway, and Finland, and in the U.S.A., Canada, and Japan.

Co-operation among forest workers is discussed in Chapter VII. The important groups of organizations in Roumania, Bulgaria, and the U.S.S.R. receive special attention; other societies described include several in Quebec and one of special interest in the Gold Coast.

In the Appendix a review is given of certain forestry organizations that are termed 'quasi-co-operative'. They include the German 'Waldgenossenschaften', some of which date back to the Middle Ages, the 'composerorate' in Roumania, and 'compulsory forestry co-operatives' in Greece and Japan.

94.4 : 60.31.2 : 98.3. **Cooperative management and marketing for the woodland owner.** *Fmrs.' Bull. U.S. Dep. Agric.* No. 1927, 1943. pp. 16. [Division of State Forestry, U.S. Forest Service.]

Although farm woodlands make up 18 per cent. of the total farm area of the United States, they contribute only a small part of the total farm cash income, largely because neither the woodlands themselves nor markets for their products have been developed. The opportunities offered by co-operatives for forest products might, therefore, be profitably studied. The purpose of this bulletin is to outline briefly: (1) the fundamentals of co-operatives, (2) possibilities in woodland owners' associations, and (3) the activities of several existing, representative, forest products associations.

95. FOREST TAXATION, LOANS AND INSURANCE

95.1 (42.1–9). HART, C. E. **A simplified statement on taxation of woodlands in England and Wales.** *Quart. J. For.* 38, 1944 (21–31).

This statement deals with (1) Income Tax and Sur-Tax, with reference to liability to payment by owners and occupiers of woodland, basis of assessment, Income Tax on sporting value, and effect of wartime legislation; (2) Death Duties (estate and succession duties); and (3) Excess Profits Tax with note on repayment of certain E.P.T. after the war.

95.3. KISSIN, I. **Forestry credit.** *Tech. Commun. Imp For. Bur.* No. 3, 1945. pp. 27. [E.span.port.]

This Communication, based on a comparatively wide range of evidence, is a study of the special features of, and some of the experience gained with, forestry credit.

Chapters I to IV are general. The functions of forestry credit and the special problems associated with the mortgage of forests are discussed, and a classification is made of the various types of credit employed in forestry production. Some general trends in the provision of forestry credit are outlined with reference to the type of credit institutions that have advanced forestry loans, the restrictions often imposed on these loans, and the provision and use of subsidized forestry credit and of afforestation credit.

Chapters V and VI deal with the position in a few countries in which developments of interest have taken place, including Germany, Norway, Denmark, and the U.S.A. The very significant official proposals made in the U.S.A. for the improvement of forestry credit facilities, aiming *inter alia* at establishing a Forest Credit Bank that would embody a forest insurance organization, are discussed in some detail.

Chapter VII includes notes on credit in British forestry and on forest mortgage credit in Canada, South Africa, and Australia.

96. POLICY REGARDING AFFORESTATION

96.5 (41.5) : 23.3 : 97.1. **Afforestation and national planning.** *Irish For.* 1, 1944 (3–5).

Irish imports of timber average 100,000 to 120,000 Petrograd standards of sawn timber annually, mainly in softwood species from Scandinavia and the Baltic. These species can all be successfully grown in Ireland. The afforestation of some 700,000 acres in Ireland has been advocated, both in order to reduce imports and to increase rural employment. One of the chief obstacles to this aim is the difficulty in acquiring the necessary land in sufficiently large blocks.

96.5 (410) : 23.2–3. BOURNE, R. **Old woodland soils? Replanting cleared areas or extension of afforestation? How to achieve three-fold increase in timber yield.** *Timb. Tr. J.* 171, 1944 (435–6).

With reference to the proposals of the British Forestry Commission [cf. *For. Abstr.* 5 (211)], it is urged that more attention and encouragement should be given to the restoration of old woodland, whether or not large new areas of forest are planted.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

97.1 (66.9) : 98.1. MACKAY, J. H. **Perspective in land planning.** *Farm and Forest* 5, 1944 (10–6; 99–107).

It is commonly said that what is most required for the economic prosperity of West Africa is a fair price and an assured market for its products and the establishment of secondary industries to manufacture primary products. But in fact the land for the most part is poor, and the most urgent problem is to renew and maintain fertility, a matter that requires intensive research. There are two facets to the problem, the maintenance of soil fertility in land already under cultivation, and the rehabilitation of land that has gone out of cultivation. A redistribution of population will not solve the problem, though it will soon be necessary

a measure of relief. The two principal dangers are osion and laterization of the soil, and much could obably be done to check the one by contour cultivaon with strips of grass or *Acioa*, and the other by fire otection to encourage forest vegetation, which may so have an important bearing on climate, ensuring a etter distribution of rainfall in areas adjacent to the rest. Until this latter possibility is either established disproved, as many forest masses as possible should protected. They would at least form 'land reserves' provide fertile farmland for the future if their imatic value proves to have been exaggerated. Trees ave also an important role to play on farmland itself, oth as shelterbelts, in keeping the soil moist, cool and pen, and in tapping deep-lying water supplies. *arkia biglobosa* and *Acacia albida* are both excellent rm trees, and Mango might be most suitable for eld shelterbelts. Vegetation, particularly forest cover, also exceedingly important in preventing desiccation.

The biotic factor is as important as the edaphic and imatic factors. If land in West Africa continues to misused as it is now, the result will be catastrophic ithin measurable time. Amongst the dangerous ractices are over-cultivation, destruction of trees and rubs by over-lopping for fodder, and excessive grassurning. The tsetse fly is an indirect biotic factor of xtreme importance, since measures for its control in ie interests of human welfare appear to be contrary those for good land use.

Woodland and forest are also required for firewood nd building poles, timber and minor products. The onsumption of firewood in Nigeria, with its population f 21 millions, is enormous and its annual value has een estimated at more than 3½ million pounds. It is lculated that about one-tenth of the area of the ountry is required to supply the necessary amount of rewood, not in large forest blocks, but dispersed so at it is available to every community. The supply of uilding poles and minor forest products, though of reat importance now and likely to remain so for some me to come, will diminish as standards of living are ised. The development of wider markets for minor rest products is particularly desirable, as they provide ssentially peasant industries.

Annual exports of timber from Nigeria average 840,000 cu. ft. and annual local consumption is now 500,000 cu. ft. Taking the figure of 560,000 cu. ft. er sq. mile as being reasonably attainable in average rest under intensive working, present local and export equirements might be supplied from 8 sq. miles of rest a year, and from 800 sq. miles in perpetuity on a 00-year rotation; 3,000 sq. miles under proper manageent might supply the estimated future requirements of 5,500,000 cu. ft. per annum.

It is suggested that a proper distribution of land in igeria would be as follows:—

	The High Forest Region	*The Savanna Region*
	per cent.	*per cent.*
armland . . .	60	42
and reserves . .	17	33
imber reserves* .	4	10
rotection reserves .	19	15

* Fuel reserves included in figure for the Savanna egion

Regional surveys must be undertaken to sketch in the detail for local planners; aerial survey is undoubtedly necessary for filling in the major features.

97.1 (68.9) : 11.49 : 12.19. TRAPNELL, C. G. **The soils, vegetation and agriculture of North-Eastern Rhodesia. Report of the Ecological Survey.** Govt. Printer, Lusaka. 1943. pp. vi + 111.

The field investigations on which this account is based were carried out in 1937, 1938 and 1940. The report is on similar lines to the previous report on North-Western Rhodesia, but more space is devoted to agricultural aspects. There is need for forestry assistance in all 4 divisions of North-Eastern Rhodesia, but especially in the Northern province, on account of the potentialities as sources of timber of the Chipya (high grass/mixed woodland) areas of the Chambezi-Bangweulu basin and the maltreated Mushitus (small strips and stands of evergreen timber trees, generally growing along the margins of perennial streams). The protection of Mushitus is generally needed. Conservation measures are widely called for in Chipya areas, particularly in the Kasama and Fort Rosebery Districts. Afforestation trials with Pines and other trees have been proposed for the upper Luapula and Bangweulu shores in the latter district. Experiments on plantation crops are desirable in these moister areas.

97.1 (729.2) : 96 : 12.26–8. SWABEY, C. **Reconstruction in Jamaica.** *Sylva* No. 25, 1944–45 (19–20).

In 1942 a long-term programme of afforestation works for Jamaica was proposed. The main objective is the production of general constructional timber, largely for house building. A total sum of £250,000 has been secured for use by the Forest Department during the first ten-year period. The following are the major undertakings called for in the programme:—

Afforestation of 23,000 acres.
Purchase of 10,000 acres of private land.
Cadastral and boundary surveys.
Construction of bridle roads and buildings.
Silvicultural research.
Timber cruising and utilization research.
Training of local staff.
Increased field and clerical staff.

The main species at present being used in afforestation are Mahoe (*Hibiscus elatus*), Santa Maria (*Calophyllum antillanum*), Cedar (*Cedrela odorata*), Broadleaf (*Terminalia latifolia*), Podo (*Podocarpus usumbarensis*), and Juniper (*Juniperus lucayana*).

97.2 : 60.31.2 : 24.4. PRESTON, J. F. **Woodlands in the farm plan.** *Fmrs.' Bull. U.S. Dep. Agric.* No. 1940, 1943. pp. 22.

This bulletin is for the information of farmers interested in developing and improving their woodlots, and deals with lands suitable for woods, the essentials of farm-woodland management, the growing stock, management of growing stock, pruning, thinning, interplanting, release cutting, protection from fire, and control of erosion. It also briefly outlines the financial and other benefits to be derived from woodland management.

98. THE TIMBER MARKET

98.1 (4). **No softwood famine: producing countries and their export possibilities after the war.** *Timb. Tr. J.* 169, 1944 (341–3).

It is concluded that while the softwood timber supply in Europe, apart from Sweden, will no doubt be seriously curtailed during the period of reconstruction after the war, the North American Continent should be able to meet European import requirements. For Europe generally, this would amount to some 750,000 standards; it is noted that in 1937 North America exported to Britain nearly 600,000 standards.

98.1 (4) : 98.3. Europas Holzüberschussländer. **[The wood surplus areas of Europe.]** *Holztechnik* 23, 1943 (41). [G.] P.R.

A brief resumé of conditions in the timber export trade of Hungary, Czechoslovakia, Rumania, Croatia, Bulgaria, Sweden and Finland, with special reference to Germany's present and future requirements of timber.

98.1 (43.1–5). Holzbeschaffung-Holzverwendung. **[Wood production—wood utilization.]** *Holztechnik* 22, 1942 (280–2). [G.] P.R.

From the point of view of German timber production the following recommendations are made: (1) increase in sustained yield, (2) higher imports, and (3) better methods of exploitation. From the point of view of timber utilization it is suggested that measures to be adopted should include: (1) the greater use of wood substitutes, (2) improved methods of utilization in woodworking and other industries, and (3) economy in use.

An outline is given of the work and organization of the Deutsche Gesellschaft für Holzforschung.

98.1 (73) : 33.02. **Pulpwood situation in U.S.A.** *Pulp Paper Mag. Can.* 45, 1944 (905–6).

The upward trend in pulpwood receipts in the United States continued in August 1944. Receipts for the 8 months of 1944 (11,414,000 cords) compared with the like period of 1943 (9,507,000 cords) showed an increase of almost 20 per cent. Domestic receipts for the 8 months of 1944 (10,328,000 cords) were about 25 per cent. greater than those for the corresponding period in 1943, while imports (1,086,000 cords) were about 6 per cent. below 1943. Consumption for 8 months in 1944 (10,759,000 cords) was 7 per cent. higher than in 1943 (10,072,000 cords). Inventories at the end of August (3,337,000 cords) were 23 per cent. greater than at the end of August, 1943. The Northeast was the only region which showed a consistently unfavourable position. The main obstacle to increased production is shortage of transportation equipment.

98.1 (73). HOPKINS, H. **The timber production war project.** *J. For.* 42, 1944 (790–5).

Cf. *For. Abstr.* 6 (125). This progress report gives specific information on activities and accomplishments of the Timber Production War Project for the period August 1943 to June 1944, inclusive, during which it was able to increase the output of U.S. forest products by 1¾ billion bd. ft. (in 'measurable' cases alone), and has succeeded in improving relations between public forestry agencies and forest industry.

98.1 (931). **N.Z. timber production.** *Aust. Timb. J.* 10, 1944 (193, 208).

Timber production in New Zealand has increased from an average of 315 million bd. ft. for the years 1937–39 to 331 million bd. ft. in 1943. It is doubtful whether the sawmilling industry will be able to sustain this effort without early relief of the manpower and equipment position which has steadily deteriorated throughout the war years.

The production of *Pinus radiata* timber has increas rapidly in the same period, but demand is still great in excess of supply. Potential production is immens and conversion of afforested areas is developin whereas previously supplies of timber came chiefly fro farm woodlots and shelterbelts. A slump is foresee in the future demand for timber from farming district

98.1 (67.1–2) : 82 : 32.92–4. LESCHNER, F. D Arbeiterfrage in der Forst- und Holzwirtschaft Wes afrikas. **[The manpower problem in forestry and t timber industry of West Africa.]** *Z. Weltforstwirt.* 1 1943 (1944), (560–2). [G.e.f.]

Criticism of a previously published suggestion [c *For. Abstr.* 5 (293)] for meeting Europe's timb demands by increased supply from the Colonie notably Cameroon and Gabon. The writer points o that no sufficient reserve of labour exists in those are to carry out the proposed extension of the fore industry, and that the only labour reservoir in W Africa is Nigeria, which is no help as long as it is und a different political system. Even if the extra timb could be produced, its transport to Europe wou present enormous difficulties. The proposal to ra timber from the West Coast of Africa to Europe probably impossible because of the peculiarly difficu conditions in the Bay of Biscay. Russian experimen in rafting in the White Sea and the Baltic resulted almost total loss of the rafts.

98.1–2 (94) : 33.0. **Timber and the war. Some notes o Commonwealth organisation of production and supply and wood's part in our war effort.** *Aust. Timb. J.* 1 1944 (228–9, 231; 270–1, 273, 291–2; 310–1, 313–4, 32 354–5, 357–9, 361, 376).

The constitution, functions and work of th Australian Timber Control are reviewed. Imports c foreign timber have been cut to about one-quarter c the pre-war figure and the Australian sawmillin industry has had to make good the deficiency. Civilia use of timber is strictly controlled, but immense quant ties have been needed for war construction purposes.

The successful substitution of Australian-grow timbers for imported species has been made possibl as a result of research by Commonwealth and Stat technologists. The following are some importan instances of such substitution:—Scented Satinwoo (*Ceratopetalum apetalum*) for Birch (*Betula* spp.) in ai craft plywood, and for Walnut (*Juglans* spp.) in rifl furniture; Hoop Pine (*Araucaria cunninghamii*) fo Port Orford Cedar (*Cupressus lawsoniana*) in batter separators; Queensland Maple (*Flindersia brayleyan* for Mahogany in aircraft propellors and boat building White Birch (*Schizomeria ovata*) and Radiata Pine fo Aspen in matches; Spotted Gum (*Eucalyptus maculat* for Hickory in axe and hammer handles; Silver Quar dong (*Elaeocarpus grandis*) and Hoop Pine for Spruc in spoon-bladed oars; Queensland Maple and Scente Satinwood for Gaboon Mahogany (*Aucoume klaineana*), and for Birch in plywood panels; and Sheoa (*Casuarina* spp.) and Myrtle Beech (*Nothofagu cunninghamii*) for Maple in boot lasts.

Figures are given for the output of timber in th various States, and an account given of the grea development of the plywood industry. The limitin factors in timber and plywood production are shortage of transport and manpower, which are accentuated b the widely scattered locations of stands of timber. A

ccount is given of the quantities of sawn timber being ised in constructional work, including large aeroplane iangars, instead of steel construction. In many mportant defence projects designed in nailed timber, he use of Australian hardwoods has been essential owing to the greater nail-holding capacity of these imbers in comparison with imported softwoods which ire not suitable for this type of structure.

98.2 : 07.2 : 34.6. RISHELL, C. A. **Value of research in building and maintaining markets.** *B.C. Lumberm.* 28, 1944 (34, 48, 50).

During the past hundred years or so the wood trade has been steadily losing markets, and when shortage of materials in the present war to a great extent restored these markets, the industry, through lack of previous research work, was unable to produce such improvements as would have served to consolidate its gains. One of the few exceptions to this failure is the marine laminating programme, which was able to build on a foundation of research. The needs of the timber industry are as follows:—

(1) An analysis of the various wood products markets to determine which are worth competing for and which should be discarded.
(2) To discover which markets are most open to competition from other materials, and therefore call for the most intensive research.
(3) A programme of research designed to improve the product and fit it for successful competition.

Utilization of by-products and new and more economical manufacturing processes are the most urgent need. Research needs to be organized, to prevent waste and overlapping. Subjects which call for research are the profitable use of a greater proportion of the tree or log, reduction in cost of lumber and lumber products, methods for obtaining dimensional stability at an economic cost, to obtain better and more uniform quality in wood, fire resistance, decay resistance, hydrolysis of wood waste, distillation of wood, use of wood sawdust, development of wood for fuels.

98.2 (94). SMALL, A. R. L. **The native timber industry.** *Aust. Timb. J.* 10, 1944 (113, 123).

The native timber industry in Australia is in danger of disintegration unless it can be developed in such a way as to compete with imported products. At present it consists of a large number of small sawmills fairly generally distributed, with a native plywood industry practically confined to Queensland. Only in Tasmania and Victoria are the mills associated with seasoning kilns to any great extent. The following phases of development are suggested as necessary to keep the native timber industry in existence:—

(1) The establishment of seasoning kilns wherever economically possible.
(2) The organization of a sales and distribution system that will ensure an economic market for kiln-dried timber and other finished products.
(3) The establishment where possible of rotary peeling plants equipped with dryers, these plants to make their own plywood or supply veneer to a centrally situated plywood plant.
(4) The establishment wherever possible of other forest industries based on wood.

98.2 (941). GREGSON, F. **War-time timber industry in W.A.** *Aust. For.* 8, 1944 (40–3).

An account of the monthly production graphs for sawmills in Western Australia, prepared by the Timber Control for the purpose of stimulating production.

98.3 (73). NEAL, A. C. **How lumber prices are controlled.** *J. For.* 42, 1944 (709–14).

An account is given of the control of American lumber prices since 1942 by the Office of Price Administration, which has kept the rise in prices at a lower level than in the war of 1914–18 and has at the same time maintained production.

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